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PRACTICAL PATHOLOGY INCLUDING MORBID ANATOMY AND POST-MORTEM TECHNIQUE

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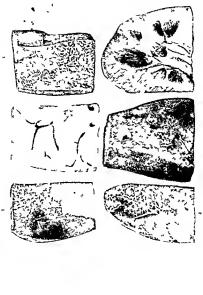
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PRACTICAL PATHOLOGY

INCLUDING

MORBID ANATOMY

AND

POST-MORTEM TECHNIQUE

CY

JAMES MILLER MD, DSc, FRGPE, FRSG

PROFESION OF PAYROLOGY, QUERN'S EMPRESHITY, CANADA, BACTREFO-LOGIST TO THE OTTABLE WARD OF WRAIN, LATE LECTORS OF MORBID ANATOMY, UNIVERSHY OF EDINBURCH LECTURES ON ANYTOLOGY AND ACTRESIOLOGY, SCHOOL OF MEDICIES OF THE KOTAL COLLEGES, FORMEDICH, AND EDIVERSHIT SCHOOL OF MEDICIE FOR WOMAIN, FERMINES IN NATHONOGY UNIVERSHITY OF AREPERN, ROYAL COLLEGE OF PHYSICIAN ENTEREDEN, AND BIRNINGHAM GENERATIVE, STC.

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PREFACE TO SECOND EDITION

Is preparing a second edition of this work the author, while bringing the subject matter up to date, has endeasoured to keep in mind the original object of the book, namely, the preparation of a handy volume for the use of the jumor student in the post mortem room, practical class, and museum. The book in no way attempts to supplant the larger text books and is not intended for the advanced student. Several portions, e.g. those dealing with the endocrine organs, appendicitis, and nephritis, have been enlarged and practically rewritten

editions to retain the proper balance of a book. In deciding the emphasis to be laid upon the commoner as compared with the trater diseases the author has perforce to fall back upon his own experience. But there is no other criterion to go upon, if the book is to have that personal touch which is so necessary

It is always a difficult matter in preparing subsequent

The author is indebted to Dr F J Browne of Edinburgh for writing the sections dealing with post mortern examination of the feetus and the new born child—sections which have added materially to the value of the book, to Dr L J Austin, F R.C S, for rewriting the note on Medico-Legal points in relation to post morteins in England, also to Dr W D. Hay and Miss E Bickham for correcting proof and revising the index

QUEEN'S UNIVERSITY, KINGSTON, ONTARIO, CANADA, April 1925

PREFACE

THE object of this volume is to give the student of medicine and the practitioner, m a handy form, the information required for practical work in relation to Pathology There will be found short descriptions of the appearances in the more common morbid processes to be met with in the organs and tissues, at the same time these are co related with the changes in the other organs and tissues of the hody in the various diseases. The main points in the microscopic appearances are also given very shortly, merely in order to remind the student what he should look for when going over his slides. In dealing with post mortem technique, fixing and mounting of preparations, cutting and staining of sections, the endeavour has been to give one reliable method in every case, rather than numerous alternative methods Hence the book is not one for the specialist. The chapter on Tumours is added to supplement the necessarily short descriptions of neoplasms under the heading of the various organs For the benefit of the practitioner, a short chapter dealing with the medico-legal aspects of post mortem work has been included. Owing to the frequent occurrence of cross references, it was decided to bind the illustrations together in the form of an atlas at the end of the book Illustrations of microscopic preparations have been omitted. as the student has his slides to which he can refer

The author has made extensive use of volumes such as Sims Woodhead's Practical Pathology, Shennan's Post Mortems and Morbid Anatomy, Orth's Pathologisch anatomische Diagnostik and Erlauterungen zu den Vorschriften fur das Verfahren der Gerichtsarzte bes den gerichtlichen Untersuchungen mensthlicher Leichen, Herxheumer's Grundriss der patho

logischen Anatomie and Technik der pathologisch histologischer Untersuchure . Mann's Physiological Histology . Mallory and Wright's Pathological Technique, Letulle's La Pratique des autopsies Adam's various works, Beattie and Dickson's Pathology, Pembrey and Ritchie's General Pathology, also Lorrain Smith and Mair's classical work on staining methods for fats in the Journal of Pathology and Bacteriology

To the personal teaching of Professors Greenfield, Muir, and Leith, and of the late Professors Ziegler and Weigert,

a deep debt of gratitude is also due

The author has great pleasure in expressing his indebted ness to Professor Harvey Littlejohn for invaluable help in preparing the chapter on medico-legal post mortems and for his permission to use two typical post mortem reports lis thanks are also due to Dr John Fraser for revising the chapter on diseases of bones, to Dr James Young for rany suggestions in Chapter VII, to Dr W G Porter for assistance in preparing Figure 12, to Dr Sidney Smith for the use of his fine preparations illustrating centres of ossification in the mant in connection with the table on p 300, also to Mr W. Waldie of the Royal College of Surgeons' Museum Edinburgh, for his advice as to the fixing and mounting of specimens

The illustrations have, with one or two exceptions, been made by Mr Glass from preparations in the author's collection For the care and trouble taken, the author wahes to express his hearty thanks. If acknowledgment has not in every instance been made to the physician or surgeon who had charge of the case, the author bers to offer his apologies His thanks are due to Professor Sutherland for the specimen from which Fig. 33 was drawn

For much useful advice and criticism I have to thank the Fditor of the Edinburgh Medical Series -- Dr J D Comme For reading the proofs and for drawing up the m lex I have to express my heart; thanks to my assistant, Dr Ferrus Hewat.

IM

SURCEOUS HALL, LOINBURGH. October 2", 1913.

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PRACTICAL PATHOLOGY

CHAPTER I

INTRODUCTORY

The post mortem examination, sectio cadavers, or autopsy is an essential part of the scientific investigation of all fatal cases of disease. It is obvious that only by its means can the medical man acquire an accurate knowledge of the nature, extent, distribution, and complecations of a morbid conduct. It is not too much to say that however plain and simple the diagnosis of a disease may be, some additional light will be thrown upon the case at the post mortem examination. In a very considerable number of instances, conducts quite interpreted during life will be found, and, in a few, the diagnosis of the clinician will be found, and, in a few, the diagnosis of the clinician will be controly upset by the pathologist's investigations.

A post mortem examination should therefore be performed whenever feasible. Further, the examination should be as thorough as possible should, in other words, include as many parts of the body as possible, and should be followed by microscopic, and, if necessary, bacteriological examination of the diseased organs and tissues. In not a few instances the pathologist's view of a case obtained by naked-eye

examination alone is greatly altered by subsequent microscopic or bacteriological investigation

For example, in a case which came under the author's notice there was a stricture of the small intestines which, from the clinical history as well as from the naked-eye appear ances, was believed to be malignant. Microscopic examina ton showed the condition to be tuberculous.

In another case, where harmorrhagic infiltration of the mediastinal tissues was the main post mortem finding, the true nature of the disease was only found on making cultures, when a pure growth of the antitrax bacillas was obtained, the case proving to be one of "woolsotter's disease."

From another point of seew a post mortem examination may be required, that is the medico-legal Cases of suspected posioning may prove to be ordinary diseased conditions, and, rice erris, cases where fool play is unruspected may turn out to be due to posioning.

To gue another example from the authors expenence A well to do contractor died suddenly with symptoms of severe pandice. His will was known to be drawn out in favour of the foreman of his works, with shom he lived. The medical attendant considered phosphorous postuming a possibility, but post mortem examination revealed the presence of a large impacted calculus in the common bile due.

In all cases of sudden death where the cause is unknown, or of violent or suspected violent deaths, notice must be sent at once to the Procurator Fiscal or Coroner. Such bodies become the property of the Fiscal or Coroner, and cannot be touched without his consent (For further information on this point see Chapter AV)

Precautions to be taken.—Before proceeding in any way to carry out a post mortem examination, it is absolutely necessary that the permission of the nearest relative of the deceased be obtained. In certain hospitals, trore happily situated than their fellows, the regulation is, that unless

notice to the contrary be received from the relatives within twenty four hours of the death of the patient, an autopsy will be performed. This is a far better system than the one under which permission has to be asked for in each case When not confronted with the choice, the relatives, as a rule. except in the case of certain religious creeds, think little of the matter When permission is asked for, they at once begin to conjure up visions of mutilation, and it requires in most instances no little fact on the part of the medical man to obtain permission. In every case, however, where leave has to be asked, it should be obtained in writing from the nearest relative. The absolute necessity for this precaution. if the doctor is to protect himself, has been emphasised on several occasions recently in the law courts. In a case tried before the Court of Session in Edinburgh, the judge, in charging the jury, said that the holding of an unauthorised post mortem 'gave a legal remedy,' and that when per formed without consent "the case would be treated very smartly", further, the defender, a medical man who had performed the sectio, "would have been well advised had be obtained permission from the father in writing *

Medico legal Cases —When the case is a medico-legal one, it is necessary to receive permission from the Procurator-Fiscal (Scotland) or the Coroner (England) before a post mortem examination is performed. This permission having been obtained, none other is required. Although in all cases it is advisable to take full notes at the time, these should be taken with special care in cases which have, or are likely to have, a medico-legal aspect (e.g. workmen's compensation cases)

In certain cases with a medico-legal aspect the Coroner or Fiscal will order an autopsy to be performed. When reporting such a case the pathologist should avoid as far as possible the use of technical terms. In Scotland such a report requires to be drawn up in what is known as the "soul and conscience form" (see Chapter XV)

Importance of Post-mortem Change—It is quite obvious that the sooner the post mortem examination is carried out after the death of the patient the better, but unless there is any special reason to the contrary it is usual to wait for twenty four hours

The changes which begin to take place in a body after death tend to mask, and eventually to obliterate entirely, the characteristic appearances of most pathological conditions Diseased conditions have been found in Egyptian mummies. and carres of teeth and evidence of rickets in the skeletons of prehistoric men, but as a rule the softer parts, and more parts cularly the hollow viscera and abdominal organs, rapidly lose the characteristic signs of disease through decomposition The extent and rapidity of this change will, of course, depend upon circumstances The processes take place much more ranidly in warm weather Conversely in cold weather, or if, ax is possible in some hospitals, the bodies are placed in an apparatus artificially cooled, they will retain their freshness for a much longer period Another factor bearing upon this is the disease from which the patient has died. In septic conditions, more particularly in the abdominal cavity, decomposition occurs more quickly, and tends to alter the appearance of organs in the neighbourhood,

Furtherrore when preservatives have been injected into the cavities of the body as is often the case in America, due allowance has to be made for the effects of strong formalin on the viscen.

CHAPTER II

THE EQUIPMENT OF THE PATHOLOGIST

Rubher Glores—One of the most important parts of the pathologist's equipment is a good, sound pair of rubber glores. Fifteen or twenty years ago gloves were seldom worn. In consequence, those carrying out post mortem work suffered periodically from septic wounds, if not from the more serious infections, such as tuberculosis. Nowadays there is no excuse for such accidents, as gloves are cheap, and with care they last a considerable time. The best type of glove is the thin rubber glove used by the surgeon. The thicker ones naturally last longer, but they are more expensive, more difficult to work with, and are more troublesome to mend.

It is very necessary that the pathologist should care for big gloves, seeing so much depends upon them. During a post mortem the gloves should be frequently washed under running water to prevent the drying of blood or pus upon their surface. After the operation is finished, they should be washed while on the hands, first with soap and water, and then with water alone, afterwards dued, and while still on the hands moistened all over with biniodide of mercury spirit (biniodide of mercury a part, methylated spirit sool and dired again with a towel. If punctured, the

interior of the glove should, of course, be similarly treated. The exact position of a puncture can be found by distending the glove with water. A patch can then be applied, just as one mends a punctured tyre. The gloves should subsequently be folded up and placed in the cardboard box supplied with them.

them

If long intervals elapse between post mortems, the gloves
may become hard and brittle A few minutes' immersion in
hot water will make them soft again.

Where gloves are not obtainable, the hands may be smeared with carbolic oil

Post-mortem Wounds—In the case of a punctured wound obtained at a post mortem it is well to wash the part thoroughly in warm water, suck it, and then dress it with some weak antiseptic, such as i ao carbolic. Some recommend the use of pure carbolic or other strong and in the first instance. If slight, the wound can be covered with a layer of cellodin dissolved in equal parts of alcohol and ether, or with 'new skin "

In his movements with limite or needle, the pathologist should always be slow and cautious. When dealing with purulent or other infective floid, or with frecal material, great cure should be taken not for splash is about. Severe eye infections sometimes result in this way, and the author knows of cases in which typhoid infection resulted from the splashing of infected faces. For this reason it is well to accord using a strong it on of water when washing intestines, or, indeed, at any time

Eye Infections — When some foreign material has entered the eye, the conjunctival sac should be washed out with a little warm saline. The method of washing out is to place the individual on a chair with head well thrown back, and to squeeze the saline fluid into the eye with a piece of cotton wook. There is no need to use an anticeptic, as the

conjunctival sac can of itself destroy a considerable amount of infective material. The object of the washing is merely to remove as much of the irritant as possible. In any case the eye should not be rubbed or arritated in any way

Another source of danger for the pathologist is flies These are excessively troublesome in warm climates, and are, undoubtedly, a means of conveying infection. Fly papers will be found useful in reducing the number

Turning to the question of instruments, these need not be numerous or elaborate The following are essential -

Instruments - 1 A sharp large-bladed knofe for making incisions in the skin and for removing organs. Several of these should be kept

- 2 A long flat knife for cutting into the solid organs
- 3 A straight probe pointed bistoury for opening the heart, the smaller vessels, such as the coronary arteries for opening the bronchi, and for incising the dura and cutting nerves in removing the brain
 - 4 A pair of dissecting forceps for finer work
- 5 A pair of fairly large round ended scissors for opening the bonel These may be of the special type commonly used but an ordinary pair, provided the edges are sharp and the ends blunt, will do almost equally well
 - 6 A good saw with removable back,
 - 7 A chasel
 - 8 A wooden or soft metal mallet
 - 9 Several flexible probes

 - 10 A packing needle
 - 11 Strong twine
- 12 Wooden cones for measuring the diameter or tircum ference of the heart valves (eg those advocated by Shennan) will be found useful

In addition it is well to have one or more sharp-pointed scalpels for any finer dissection that may be required . also a

pair of small sharp-pointed sessors for fine work, a catheter, sponges, and a wooden block for supporting the head. A screw-driver for coffin hids may also on occasions be found useful.

Knives should, of course, be tharp, and it is advisable to have the means of sharpening them at hand, in the shape of a hone and od. With a little practice it is possible to put a keen edge on a kinfe in a very few menutes. Instead of the finer large knives sold by the instrument makers, butther a knives will do admirably, and will cost a fourth or fifth of the nince.

Another necessary item in the pathologist's equipment is a pair of scales with weights from one gramme to five kilos, and a foot rule with inches and fractions of an inch marked on one side and centimetres on the other

Post-mortem Table and Accessories -The post mortem table should be at least 6 feet long and 2 feet broad should be either a solid slate slab or wood covered with zine The edge should be raised, and runnels arranged so that fluids will mass to a central waste-pipe enclosed in an iron nillar supporting the table, and on which it revolves There should be a plentiful supply of water, a tap overhead with hose attached, a basin with hot and cold supply close by for washing the hands, a large sink with an ordinary tap, and a tap with rose attached, used for washing organs, the stream from which can be easily controlled by the operator either by the foot or elbow The operator should frequently cleanse his gloves under running water to prevent blood, pus, or other discharge from drying on them Another useful accessory on the table itself is an ordinary cheap galvanised iron pail with six or eight perforations half an inch in diameter within three inches of the brim A rubber or metal tube from a cold water top is led into this and a constant stream of water permitted to flow Organs may be dipped into the

pail and their surfaces in this way freed of blood or discharges It is, however, well to remember that tissues which it is desired to mount subsequently should be washed as little as possible Lightly scraping them with a flat kinle is a better method of removing blood or discharges

It is useful to have accessible a number of bottles containing reagents likely to be required, such as Gram's jodine for testing for waxy disease (see p. 446), dithe by drochlone acid and ferrocyanide of potassium for testing for hemosiderum the organs (see p. 435), to per cent formalin, and other fixatives for tissues, and a supply of empty bottles with corks.

A Bunsen burner, a platinum needle, a piece of metal for searing the surface of organs, slides, and culture media should be close at hand. A number of large sponges will be found very useful for mopping out cavities, also a glass measure and a syringe and trocars for injecting specimens with preservatives. A large jar of Picks or other fixative should be at hand for this purpose, and pots of various sizes for containing specimens.

The post mortem room of a hospital should be in a detached building. The room itself should be any and well lighted It should communicate with a preparation room, and a laboratory for microscopic and bacteriological work. The bodies should be stored each in a separate numbered receptacle, if possible communicating on the one side with the mortuary, on the other with the post mortem room. They should be placed on carriers running on rollers which can be manipulated from either end. The whole of this storage system should be artificially cooled. This artificial cooling is of immense unportance in order to delay the progress of post mortem changes.

The operator should, of coorse, wear a clean overall to protect his clothing. A waterproof apron over or under this is advisable. A pair of spectacles for the protection of the even us a good thing.

Note-taking—Previous to the performance of the sectio, a short risumle of the main clinical features of the case should be sent to the pathologist. Notes dictated by the operator during the sectio should be taken by a competent person. This is absolutely necessary, as the more maintee points in the case cannot be put down unless the organs are actually before the operator. Organs change considerably in colour even during the course of the sectio, so that it is not safe to trust to the description of a case written up afterwards, even when the more important organs are preserved. It is well that the route now of these notes should be rone over all that the route now of these notes should be rone over all

corrected as soon after the sectio as possible

Post-mortems in Private -- In carrying out a post mortem in brivate, the body should be placed on a kitchen table, with an old sheet and newspapers, or, if possible, a naterproof sheet, undemeath Sometimes the bed is the only place available, in which case the waterproof is very necessary. The head should be supported with a brick, a block of wood, or a suitable box wrapped in newspaper. A slop-pail and basins, with a pfentiful supply of water, should be procured To mask unpleasant odours, a piece of twisted brown paper lit at one end, the other end being thrust into a jug and left to smoulder, or a handful of ground coffee thrown on a shovelful of burning coals will be found useful In private, if the spinal cord has to be examined, it is well to begin with that A number of newspapers, bottles for specimens, sponges, soap and towels should not be forcotten When large quantities of fluid are present in the body cavities or in hollow siscera or tumours, it is well to remove this before going far with the examination. This may be done by the use of the sponge or by making an opening or inserting a trochar in a dependent part and allowing the fluid to drain away into a basin or pail

Rules to be observed in examining Organs -- A few

simple rules should be borne in mind when examining an organ It is well to have some definite method in order that nothing be passed over. The student should remember, in the first place, to look before touching, the former being much the more important process Note in the first instance the size of the organ, and mentally compare it with what, in your experience, is the normal size, remembering always that the age of the subject from which the specimen was taken is an important item in drawing a conclusion as to size The general form of the organ should next be examined. and any deviation from the normal noted, such as swellings or shrinking Examine next the surface of the organ. looking for exudate, which, if recent, is friable and readily

scraped away, if organised, it is stringy and difficult to remove Opaque, white, pearly areas indicate chronic inflammation Cicalrices with indrawing or puckering of the surface indicate old infarcts or healed tuberculous or syphilitic lesions A finer roughening, giving the appearance of morocco leather, is always indicative of fibrosis in the organ. Before cutting it the organ should be carefully weighed and measured. In the case of the heart, however, at as usual to weigh after the removal of all blood clots Next, the organ should be incised, and in doing so some idea of its consistence may be arrived at An organ which is the seat of fibrosis will be tougher and more difficult to cut In massing an organ it is usual to do so from the rounded outer and broader surface towards the root or blum where the

vessels enter and the ducts leave

The cut edge is another point to which attention should be directed, and which bears upon the question of consistence A rounded edge after a cut indicates soft consistence and is associated with cloudy swelling and fatty change, a sharp edge is found when the organ is firm That is the reason for the existence of a sharp edge in organs the seat of amyloid disease—the waxy material gives consistency and firmness

to the tissue, unless complicated by other degenerative conditions, such as fatty change

The student is ant to consider that in diseased conditions associated with fatty change, a greasy feel is imparted to the organ As a matter of fact, adipose tissue and fat generally is greasy to the touch, but it is only comparatively rarely that fatty change (when the change is actually a degenerat ive one in the parenchymatous cells) gives to the organs which are the seat of the change a greasy sensation when touched

The next step is to examine the cut surface The colour and any irregularity in the distribution of the colouring should be noticed The presence of bands of fibrous tissue, pigmentations of various kinds, opaque spots Grey, trans lucent areas indicate waxy disease or accumulations of cells, such as tubercle focu and leukæmta. Opaque white spots are indicative of degenerative and necrotic foci, such as areas of focal necrosis in the liver in typhoid and eclampsia, areas of caseation in tuberculosis and syphilis, and calcareous foci The last are, of course, hard and gritty to the touch Note also the condition of the ressels of the organ If they stand out prominently, it is an indication that their walls are thickened Their contents should also be noted, whether that is fluid or solid, and the character of the clot if present The presence of gas in the blood should be looked for

Use of Knife in making Incisions -In incising an organ. the way in which the knife is used is a matter of no little importance The knife should, in the first place, be a large one, considerably larger than the organ itself, the larger the better It must, further, be a sharp kmile As regards the character of the cut, the knue should be drawn alone and not pressed into the substance of the organ The cut made by drawing the knife leaves a smooth surface, that made by pressing the knife leaves a rough surface Further, the cuts must be large and sweeping not a to and fro movement which will leave a series of ridges. If possible, the whole cut should be carried out in a single sweep. As Virchow was accustomed to say to his students, "Smooth, though wrong, incisions are better than correct and unest ones."

Channels such as the common bile duct, also medium sized and small atternes, should be shit longitudinally, using a pair of dissecting forceps and sharp pointed seisors. It is often well to free and isolate the channel by dissecting it out before opening it. This can be done by careful dissection with the point of a small kinfe.

In all medico-legal post mortems it is essential to avoid unnecessary cuts. Channels suspected of having been subjected to injury (e.g. the vagina in cases of procured abortion) should be carefully examined before any sharp instrument is introduced unto them.

CHAPTER III

METROD OF PROCEDURE

Object of Post-mortem Examination.—The object of a post mortem examination is twofold—first, the discovery of the disease condition which has led to a fatal termination in the particular case in point, second, the investigation, as minutely as possible, of that disease condition with a view to advancing medical science in general

The first object may in some cases be attained by the most cursory examination limited to a single organ or part; in other cases only the closest attention to detail and the investigation of the apparently insignificant will be followed by success, the second object can only be attained after every system has been examined with the greatest care and after minute investigation, assated by the increascope, and, it may be, by the chemical laboratory. It follows from this that wherever possible a detailed examination should be carried out. There are cases where the cursory investigation will give all the information required, but in a large proportion of cases the pathologist is not doing lust duty unless the more detailed examination be resorted to, that is, provided always permission for the extended sectio be obtained and the time and apparatus be available.

Necessity for definite Plan of Operation.-In order

to carry out this detailed examination some definite plan of operation is necessary. In other words, before starting to carry out the autopsy it is quite essential that the operator should have some idea of how he is going to proceed of the order in which he is going to examine the various body cavities and their contents. It is by no means necessary to adhere to the same plan invariably. In fact, the experienced pathologist will after his routine frequently, according to the indications given him by the clinical history as to the parts actually diseased. At the same time it is advisable to have some definite plan, some order in which the various parts are to be examined, so that no detail may be omitted

It is generally stated that it is better to begin when possible with the head, as otherwise blood may escape from the vessels of the head while the thorax is being examined, and so appearances be altered. This is not a very strong argument. Virchow long ago emphasized the necessity of opening the abdominal cavity before the thoracic, in order that the true position of the disphragin might be assertained. As a matter of fact this is usually done, but not for that reason. As a rule, after making an examination of the organs in stin and of the large serous scae—pleura, perioardium, peritoneum—one begins with the more detailed examination first of the thoracic organs.

Different Methods of Procedure—As Letulle points out, there are really two parts in a complete autopsy (2) The examination of the cerebro-spinal system (2) The examination of the examination of the examination of the suscers. One might add as a third part the examination of bones, muscles, vessels, and nerves. But having admitted that this division exists, it should be realised that the further examination of these parts, more particularly in the case of the viscera, must be carried out in continuity. That is to say, taking, for example, the vascular system,

heart, arteries and vens should be examined before cutting intrough any large vessel. The almentary system should be exposed and inspected from pharyax to rectum before it is divided into sections, more than that, the various canals, such as bile and pancreate duets, must be examined while they are in continuity with the almentary tract. This is the ideal method, and it is the method advocated and carried out by Letulle and others. The whole of the thorace and addominal viscens are removed and examined first in continuity, and then the various organs removed and examined by themselves. In practice, however, the method is some what tedious, and cannot in many instances be carried out, owing to leave being obtained for the examination only of certain parts of the body.

Two great rules emphasised by Orth should always be kept in view. The first is that a part should never be removed from its pointion before its relationship to its surroundings has been citabilished. Thus the heart should never be removed for examination before the contents of the pulmonary actery and its larger branches have been investigated Secondly, no part thend be taken easy if the removal of it will interfer with the investigation later on of other battle.

To sum up, it is well for the pathologist to have some routine to which he is accustomed, thus avoiding the danger of omissions, but this plan may be modified according to the exigencies of the case

Surface Examination —First there comes the examina tion of the body, before any incision is made. The following points should be attended to —

Decomment of the Body — Height, breadth, etc., presence or absence of deformties. Any alterations in the shape of the chest should be particularly noted, the barriel-shaped chest of branchists and emphysems, the pigeon breast indicative of rickets in early lide age two common malformations. Nutrition —Whether the body is well nourished, poorly nourished, or emaciated

Age and Sex

Presence and degree of rigor morts: This is observed first in the muscles of the face, and spreads from above downwards, passing off in the same order. The time of onset of rigor mortis varies according to the time which has elapsed since death and according to the cause of death. In cases of sudden death due to injury of the spinal cord, in tetanus, in strychnine poisoning, and in wasting diseases, such as tuber culosis and cancer, the condition may come on very early. As a rule it appears in from three to six hours after death. Usually the condition begins to pass off in twenty four to forty-eight hours, the time depending upon the cause of death and the conditions under which the body is kept. In septic conditions and in warm weather rigor mortis passes off modify.

Alteration in Colour - Pallor Any deepening of the normal colour of the skin or the presence of saundice

Limity—This naturally occurs after death, owing to the accumulation of blood in the dependent parts. Post mortem hindity is this most marked in dependent parts. Where they or face are hind, some abnormality in the circulation or death from suffocation may be suspected. Lividity may also be due to briusing. Such livid patches, when pressed upon, remain of the same colour, unlike post mortem lividity, which can be pressed away. When briused parts are cut into, the blood is found diffused through the tissues. A livid colour along the lines of the superficial vessels may be due to the advance of decomposition, owing to the diffusion of the blood-colouring matter into the surrounding tissues Green coloration, an indication of the onset of decomposition, should also be noted. It appears first over the abdome and in the spaces between the lower ribs.

Skin eruptions, superficial tumours, scars, or recent

wounds should be carefully noted, and their extent esti-

Note the presence of orlena and its distribution. It is usually most marked about the feet, ankles, and legs. The next most frequent sites are the genitals and face. Eddema tous tissues often have a clear, translucent appearance. They are pale from absence of blood, soft, and they put on pressure

Examine the various orifices of the body—mouth, nose, ears—for discharges, foreign bodies, etc. Note the condition of the teeth Examine for the presence of inguinal or femoral hernia. Note the condition of the external genitals

Primary Incision -Standing on the right side of the body, the pathologist grasps his knife firmly with the right hand (Fig. 1) The incision is commenced either immedi ately under the chin, at the thyroid cartilage, or just above the manubrium sterns in the middle line. It is carried downwards through skin and subcutaneous tissue to left of the umbilious, as far as the symphysis pubis. Any cicatrices or recent incisions should be avoided. Care must be taken not to go too deeply when meising the abdomen, in order to avoid cutting the liver or bowel At one point usually in the epigastric remon, the incision is carried through muscle and perstoneum into the cavity. The index and middle finger of the left hand are then inserted into the opening, and separated so as to put the tissue on stretch (Fig. 1) With the knife the incision is prolonged the two fingers following down, to the pubes To obtain more room, the rectus muscle on either side should be cut transversely through unmediately above the pubic bone without injuring the skin

In cases where permission is obtained only for the examination of a part of the body—eg thorax or abdomen—the incision should be correspondingly limited

Reflection of Skin and Muscles —The next step in the process is the dissection of the skin and muscles of the chest

from sternum, cartilages, and ribs, and, at the same time, of the skin of the neck from the subjectnt tissue This should be done by grasping the skin, etc. with the left hand and steadily pulling away from the sternum or ribs The areolar tissue and muscles are then touched here and there with the edge of the knife as they are put upon the stretch (Fig 2) At this stage the operator will be in a position to determine the amount of subculaneous fat, also the appearance of the muscles, which in wasting diseases are often abnormally dark and dry, and in toxic conditions such as typhoid fever may show (more especially the recti abdominales) translucent, glassy looking areas-the so-called vitreus degeneration of Zenker Also at this stage the mamma may be incised through the pectoral muscles and examined for growths, etc. The ribs should also be examined for fractures and enlargement of the costo chondral junctions (rickety rosary) At this stage also some estimate of the relative moistness or dryness of the tissues should be made. Ædematous tissues exude fluid on incision

Removal of Sternum.—Before opening the thoracic cavity the level of the duaphragm may be noted Note also the level of the lower border of the liver, and the position of the stomach and other viscera, as regards the lower costal margin Then, commencing at the second costal cartilage close to its attachment to the rib, and cutting obliquely outwards, so as to avoid myuring the underlying lung, one divides the cartilages on either side

In many cases of muscular, and more particularly of old men, it will be found impossible to do this with a kinfe. The saw should then be used, and the cartilages severed, holding the saw perpendicularly to the ribs. Great care should be taken not to splinter the ribs in any way, so to avoid puncture wounds of the hands in subsequent manipulations. An excellent way of avoiding such wounds in to fold the skin. which has been dissected from sternum and ribs in over the severed ends of the ribs

The sterno-descude point on either side should then be dissatisticated by inserting the point of the kinife perpendicularly (Fig. 3), the kinife being afterwards turned edge out wards, the incision prolonged between clavicle and first rib for half an inch, and the nib cartilage divided external to the point of disarticulation. If the cartilage of the first rib so sisfied it will be necessary to use a paur of bone force or a saw to divide it. In these manipulations great care should be taken not to unjure the large underlying veins. This may be a difficult ratter if they are distincted. The point is that any blood which escapes from them will tend to flow into the pleural sizes and mingle with the fluid there.

The sternum and cartilages should then be remoted from below upwards, the displinagmatic attachment being, in the first instance, out through I fit he stemum be firmly adherent to the mediastinal tissues, great care should be taken not to damage aneurysm or tumour, to which this adherence may be due

Serous Sass —The removal of the sternum opens both pleural cavities, and at this stage of the proceedings the terms sad—peritoneum, pleura, and pericardium is commencing at the lower counter on the right sade and extending, the one upwards to the aorta, the other outwards to the apex of the heart In cases where are medalism is suspected the pericardual sac should be filled with water, and the right ventricel punctured and pressed, when, if air be present in the right side of the heart in playing the present in the right side of the heart, bubbles will appear The general appet of the thorace contents should at this

The general aspect of the thoracte contents should at this point be noted. The size of the heart and the extent to which it is overlapped by the lungs are points of importance.

In examining the serous sacs look for the presence of furd

in excess, note its colour, whether it is clear or turbid or blood stained Examine the surfaces of the viscera. These ought to be shiny and perfectly smooth. Any dimining of the surfaces indicates inflammatory exudate. Where there are indications of such exudate, films and cultures should be made from the fluid with all necessary precautions. Where pus or facal matter is present in the abdomen, careful search should be made for perforation of the viscera, more particularly the vermiform appendix, the lower end of the ileum, the stomach, and the duodenum. A careful examination should also be made of the surface of the viscera for any thickening or adhesions, indicative of ulcerations or tumour formations within

When blood or blood clot is present in the abdomen, search should be made for a ruptured organ, viscus or vessel. An area with adherent blood clot is often an indication of the source of the hæmorrhage

Examine for adhesions between visceral and parietal layers of pleura, and note the degree of force required to break down these adhesions

At this stage, both lungs should be freed from any abnormal attachment. If there are extensive adhesions which cannot readily be broken down, an incision should be made through the parietal pleura, and the latter by means of the fingers from from the ribs

Procedure for removing Contents of Thoracic and Adminial Cavities—Having examined the serious sizes, the next step is to remore and examine the contents of the thoracic and abdominal castities. The way in which this is done will be determined not infrequently by the nature of the case, the pathologist being guided by the summary of the clinical history, or whatever information is available. To put the matter shortly, there are two main includes of procedure. (1) to remove the organs one by one and examine

them separate from their surroundings. (2) to remove the contents of the cavities entire or in groups, afterwards to examine canals, vessels, ducts, etc., in continuity with the viscera, and then, and only then, to sever attachments and remove and examine the organs themselves Unquestionably the latter is the proper method. If the former be adopted, although in many cases no harm will be done, in some in stances points will be missed and valuable specimens be runed The experienced pathologist can, as a rule, decide whether he may risk adopting the first method, but the tyro ought, if it is at all possible, to make use of the second But even if one decide for the second method, certain options present themselves. One may remove the whole contents of both cavities together as Letulie does, but, as already indicated, this has its disadvantages One may compromise matters somewhat and adopt the method advocated by Shennan, which is excellent, but which necessitates postponing the removal of the thoracic contents (the most important organs in the majority of cases) until all the abdominal organs have been removed

The method recommended by the author is the remoral, in the first instance, of the theracise contents entire, the examination of the certific, etc., in continuity, then the separation of the organis and their investigation separately. Subsequently one deals test the adolence, from which the organis are removed, not en masse, but in groups. This should be the routine method. It has certain disadvantages ecophagus, aorta, sena cava, and thoracise duct will be cut through. Dut, as regards the first, the cases in which it is advisable to preserve the continuity of exophagus with stornach—timous of exophagus, cases of possoning, cases of severe lacimatemess from various e-tim—are comparatively rare, easily recognised, and special methods can be adopted for the preservation of the continuity. As regards norta, there is no great disadvantage in examining it in two sections. And as regards

the thoracic duct, it is only very rarely (as in cases of acute miliary tuberculosis) that it is advisable to dissect it out and investigate it in its entire length

(1) Remocal of the Organs one by one—Nothing special need be said about the method of procedure in this case it is usual to begin with the heart, then the lungs, spleen, liver, kidneys, etc. In many cases the pathologist will begin with the organ believed to be mainly affected. As far as possible Orths rules (p. 16) should be carried out. That is to say, the cavities of the heart should be opened before the organ is removed and the vessels followed up, e.g. the pulmonary artery sit as far as the roots of the lungs.

(2) Method of examining the Thoracic and Abdominal Contents by removing them in Groups —

EXAMINATION OF THE THORACIC CONTENTS

If not originally begun below the chin, the primary skin incision should be carried upwards to that point. In many cases this may not be necessary, the trachea being cut through at some point above the level of the clavicles. But in some cases it is necessary to have tongue and pharynx attached to traches. The skin and sterno-mastoid muscles are dissected away from the structures in the neck and beneath the chin The knife is then passed upwards through the floor of the mouth below the symphysis menti, and by sweeping it round on either side, keeping close to the rami of the lower jaw, the attachments of the muscles are cut through (Fig 4) tongue can then be pulled through the opening and by drawing upon it a view of the pharynx can be obtained The attach ment of soft to hard palate can then be cut through, the posterior wall of the pharyax is meised and dissected down Care should be taken to include both tonsils in the structures removed Further traction upon the tongue will then enable

the operator to tear through the loose cellular tissue attaching the esophagus to the prevertebral lascia. At some point the carotids are cut through, also the subclavan vessels. While all this is being done, attention should be paid to any enlarged glands, thromboard sense, etc., which may be met with

The lungs having been at an earlier stage freed from adhesions, a few touches of the kinfe will enable the operator, by traction on the trachea in a downward direction, to detach the thorace contents from the prevertebral lastea as far down as the diaphingm. The crophagus is then ligatured to prevent the escape of stomach contents. The esophagus, aorta, and attachment of percardium to diaphingm are next cut through and the thoracic viscera are removed and placed upon a table or in the sink.

When it is desired to preserve the continuity of the cosophagus with storach, and of the thorace duet and aorta, then the whole of the body contents (thorace and abdominal) should be removed together, as in Letulle's method. Or a compromise may be adopted and the thorace organs removed along with the storach, hiver, splicen, pancreas, and duodenium after the last has been ligatured and severed where it joins the joynum, and the large bowel detached from the storach by cutting through the lesser omentum. One of these procedures should always be adopted incases of timours of the esophagus and storach, poisoning with corrosives, and in cirrhosis of the liver.

Esophagus and Trachea—The thoracic contents are now placed, anterior aspect downwards, on the table or sink. The esophagus is alst open with a pair of lowed scissors. The trachea and broncha are opened in a similar manner. If it is desired to presene the esophagus, it can be first removed or turned to the left side. After opening the air passages, the nature of the contents of bronche and trust are noted.

Aorta.—In the same way the aorta is sht up and exarouned as far round as the ascending portion. If it be extensively deseased, its continuity with the heart should be preserved. The organs should then be placed anterior aspect upwards, and attention should in the first place be directed to the heart.

Pulmonary Artery —Incse the pulmonary artery longitudinally, and examine carefully for the presence of thrombi, following the branches going to the two longs as far as possible Very commonly post mortem or agonal clots are present, but these are readily distinguished from thrombi (see p 67)

Superior Vena Cava.—The superior vena cava should then be opened as far as the right auricle. The incision is afterwards carried down to the interior vena cava.

Heart—The heart is now separoted from the two lungs For this purpose it is advisable to get an assistant to steady the other viscera. The organ is pulled upwards and over towards the right lung, and the pulmonary venus are cut through as they enter the left auncle. After this the pul monary artery and aorta are severed. In cases where the latter is diseased it may be advisable, as already stated, to preserve its continuity with the heart. To do this, a little further dissection is necessary, the aorta being separated from the surrounding structures.

Surface of Heart.—The heart is now taken in the hand and a more careful evanimation of the surface made. Note should be taken of its shape and size, of any areas of thickened pericardium (milk spots), small hamorrhages, fibrinous exidate. The amount of subpericardial fat should also be noted. Right Aurole—Then, attention being turned in the first place to the right aurole, an incision is mide from the centre of the previous one joining the two vena cave into the auricular appendix, search being made for thempt.

Right Ventrucle—Passing the forefinger of the left hand through the tircuspid valve into the right ventrucle and grasping the wall between the finger and thumb, incue the wall of the right ventrucle by means of a probe pointed bistoury, commencing just below the pulmonary artery and carrying the incision down parallel to the interventircular sentim and half an inch to the left of it (Tix 5)

Tricumpld Valve.—Now test the rise of the tricumple valve either by means of a suitable cone or with the fingers, the normal ordice admitting three digits. The asyments of the refer should then be examined. This can be done quite easily from the aurocular aspect. One of the segments, the largest is a rule, is situated anteriorly and alightly to the left. It separates the ordice of the valve from the influidibilium or comus arteriorius, and is therefore known as infundibilium or comus arteriorius, and is therefore known as infundibilium or comus arteriorius, and is shown to the free margin of the ventructe, the third hes internally and posteriorly against the ventricular septum, and is known as the serial segment.

Palmonary Valve—The competence of the pulmonary valve is now tested by allowing a stream of water to fall from a beight into the cut end, the sides of the vessel being supported (Fig. 8). The primary increases into the ventricle is then prolonged upwards into the artery, care being taken to cut between the right and left antenor segments. Examine the segments for this derived or regentions. Before leaving

the right side of the heart examine the thickness of the muscle of the right ventricle. Note the amount of fat lying over it, and particularly if there is any infiltration of the fat into the muscle

Left Annele — Open the left auncle by an incision joining the two upper pulmonary vens. Continue the incision so as to open the auricular appendix in its entire length (Fig. 5). Examine the interior of the auncle for thrombi, vegetations, and thickning of the indocardism.

Mitral Valve — A longitudinal incision is now made into the wall of the left ventricle, somewhat anterior to the left border (Fig 5). The mitral valve is inspected from above and its diameter measured. This may be done roughly by the fingers, the valve admitting two digits. Run the kindle through the valve and out at the opening in the wall of the ventricle and cut outwards. The segments of the valve are arranged, the larger in front and to the right, between the auricular and aortic openings, the smaller to the left and behind, so that, if done properly, the cut will be between the segments.

Left Ventricle — Examine the valve for thickening, calcarous deposits, vegatations, etc., also the choral tendina for thickening, shortening, regatations, or supture. Note the appearance of the papillary muscles, incising them and examining for fibrous change. Note the colour and appearance of the muscle generally, looking for fatty and fibrous changes. Examine more particularly the state of the muscle towards the apex of the entiricle where interstitual myocarditis is usually found. Incise the interventioular septum, looking for interstitual change. Measure the breadth of the wall of the ventricle and test the consistence of the muscle.

Antic Valve—Turn next to the acrtic valve. A good way of exposing thus all es to run the probe pointed bistoury successively into the two coronsity arteries and then to cut upwards and outwards (Fig. 7) thus slitting up the acrtia on either vide, and at the same time the commencement of the two coronary arteries. Test the competence of the acrticule by a stream of water poured in from above (Fig. 8), examine the condition of the segments (there are three—an anterior and a right and left posterior) and measure the circumference

Coronary Artenes—Text examine carefully the condition of the two coronary artenes, opening up their vanous branches by slitting with kinde or seissors, or, in the case of the finer ones, by cutting them across This thould be done most carefully in cares of sudden death earth being made for impacted amboli or thrombi on attreamment patches. If required the acritic valve may be exposed more fully by cutting between the antenor and the left posterior segment downwards through the antenor wall of the left ventricle until the literal cut in the ventricular wall is reached.

Certain anatomical points revarding the coronary artenes

and their distribution should be remembered. The right vessel, which arises from the antenor since of Valsalva, is usually smaller than the left, it supplies the greater part of the wall of the right ventrole, the right auricle, and the greater part of the left arises of two branches from the artery given off unmedately after its commencement. The left coronary artery, which arises from the left posterior since of Valsalva, soon after its commencement divides into two branches. It supplies the occurred divides into two branches. It supplies the outer wall of the left ventrole and the anterior two-thirds of the septum ventructionum a small part of the right ventrole near the

septum anteriorly, and the inferior portion of the left auricle. The more important of the two divisions of the left coronary is the descending branch which passes down the anterior intercentricular groove. This branch is the one most frequently the seat of atheromatous change. It supplies the apex of the left ventricle and the septum as well as the anterior wall and papillary muscles. Hence it is in these positions that chronic interstitial myocarditis is most frequently met with

Lungs —The lungs should now be separated from the mediastinal tissues by cutting through their roots

Plenral Surface—Examine, in the first instance, the pleural surfaces, looking for peterhial hamorrhages, fibrinous exudate, fibrous thackening, puckering, and cicativistion, more particularly at the apiecs. Note the colour of the organs, especially at the posterior and the lower parts. Note also the consistence, feel for any solid areas or points at apex and along borders. Next cut into the organs by a perpendicular incision directed from above downwards, and from its outer, rounded, thick border towards its inner, antenor sharp border (Fig. 6). Other cuts should be made from the original incision forwards to the anterior border in the case of each lobe.

Out Surface of Lungs—On the cut surface, note in the first place alterations in colour, the presence of cavities, areas of cascation, etc. Next feel the lung substance and squeeze it, looking for the presence or absence of air bubbles or for the presence of fluid, note the colour and appearance of the fluid expressed. Examine carefully all solid areas, and determine whether the solidity is due to some exudate filling the air cells or to interstitual fibrous change. Suspected solid areas should be placed in a glass beaker of water. Consolidated areas suth in water.

Bronchi—Next open up the bronchi with the probepointed bistoury and note the eppearance of any find they contain, also the appearance of their wells. Open up the branches of the pulmonary artery similarly, looking for thrombior emboli. Incise the bronch of glands, noting the degree of prematition, the presence of sacrous areas or of calculations.

Lastly, the thyroid, parathyroid, and thyrus glands should be examined, also the remaining mediastinal tissue

Thyroid Oland.—The thyroid gland should be examined as regards its nee Longitudinal incisions are made into its substance and the cut surface examined for colloid material, the presence of cysts, etc.

Parathyroid Glands.—The average number of para thyroids is four They are found in close prairintly with the thyroid gland, usually posteriorly They are minute, oval, pink bodies, averaging from 6 to 8 mm in length

Thymus Gland.—The thymus gland is situated partly in the neck, partly in the mediastinum unmediately behind the manubnum sterm. It is largest during the second year of life (§ 0.0 or 20-15 gm.). Until puberty it remains large, thereafter undergoing atrophy, until about the twenty fifth year it has practically disappeared. Occasionally it may persist throughout hie. An abnormally large thymus gland has been found in certain costs of sudden death, particularly in young children. It is also found in status, lymphaticus.

EXAMINATION OF THE ABDOMINAL CONTENTS

Removal of Intestines—The first step in this procedure is to remove the intestiner, small and large. The actual exam nation of these should be deterred to the last moment, in order to avoid the edour of facul matter. Bore cutting through the measurery search should be small for any erlarged glands, more particularly easeous or calcareous glands, and the relationship of these glands to the bowel established Next look for the duodency-jeunal junction, and having cut through the mesentery at that point, place two ligatures round the bowel and divide it between them. Place a ligature also round the lower end of the return and cut it through as low of some as possible. Next cut through the mesentery, close to the bound, from the jeunum to liber-excal valve. This is easily done by pulling upon the bowel with the left hand and merely touching the mesentery with the lufe, which, however, cannot be too sharp for the purpose. The kinde should be held with its blade perpendicular to the bowel (see Fig. 9)

Having freed the bowel as far as the cacum, the latter should be removed from its attachments, along with the ascending colon and appendix. The transverse colon should next be detached from the stomach and removed with the splenic flexure, descending and pelvice colon. In this way the whole of the bowel from jejanum to rectum can be examined in continuity. As previously stated, it is well to defer opening it to a late stage in the post mortem examination.

Method of opening Rowel.—The boxel is opened by means of a pair of bowel or other probe pointed, sharp-edged scissors, along its mescrietric attachment in the case of the small, along one of the largitudinal muscular bonds in the case of the large intestine (Fig 10) The colour and general appearance of the contents should, at the same time, be noted

Examination of Intestine — Having opened the gut, take it up, piece by piece, commencing with its upper end, and wash it cargfully under a gentle stream of water. More particular attention should be paid to the lower end of the ileum, where typhoid and tubecculous ulcerations are specially found, and to the large bowel generally. Look for increase of tascularity, ulcrations, tumours, animal parasites.

Vermiform Appendix.—The appendix has been looked at during the preliminary investigation of the abdominal cavity. It should now be more carefully examined

It should always be remembered in connection with the intestinal canal that post moriem changes are most marked in the hollow riscere, and that these changes tend to mask the appearances in pathological conditions. Black and greenish-black coloration of the bowled and neighbouring organises common, and is due to the action of the sulphuretted hydrogen gas from the next upon the iron proment of the blood.

Removal of Liver, etc .- In the next place, the heer, with the stomach, duodenum, pancreas, and spicen, should be removed without disturbing the vascular and duct connections of these organs. This can best be done by standing, in the first instance, on the left side of the body, pulling upon the liver with the lest hand and cutting through its connections with diaphragm and posterior abdominal wall. Care should be taken at the start to leave intact the right suprarenal gland, which is in close contact with the liver. The duodenum is then detached by cutting through its pentoneal covering. The liver is then pulled still further over to the left side of the body, and its connection with the large vessels and retropentoneal tissue cut through Standing on the right side of the body, the cardiac end of the stomach is cut through, the spleen detached all but its vascular connections, the tail of the pancreas dissected away from left suprarenal, the left lobe of the liver freed from the diaphragm, and the whole group of viscera lifted out. It is more particularly in remov ing the intestines and other abdominal viscera that an assistant is desirable

Stomach and Duodenum.—Having placed this group of viscera in the sink or on the table near it, the first procedure is to open the stomach and duodenum. This is usually done by culting with the scissors along the greater curvature of the stomach and along the anterior wall of the duodenum of all organs, the stomach is the one which suffers most from post mortem changes, so that a great deal of what appears to be abnormal in the stomach must be discounted Look more especially for ulers and timnows towards the pyloric end of the stomach, and in the first part of the duodenum Press upon the gall bladder to see it bile can readily be made to flow along the common duct into the duodenum

Bile and Pancreatic Ducts — Incise the common bile duct and pancreatic duct, pass a probe along them, and if necessary open them up

Gall Bladder — Open the gall bladder and note its contents, the colour and consistence of the bile, and any gall stones which may be present Ascertain whether the cysue duct is patent by passing a probe along it

Laver—Attention should next be turned upon the laver In removing that organ any adhesions between it and the parieties will have been noted. Any exudate on the surface of the organ, thickenings of the capsule, accairaces, etc., should be searched for. The sire of the organ should be noted, also any alteration in shape, the presence of perpendicular or horizontal sular, such as are caused by tight lacing and the wearing of tuth belts.

OUTER SURVACE —Note whether the surface is smooth or rough, also the colour of the organ and any urregularity in colouring Incise the organ by means of a number of cuts in a perpendicular direction. Note the character of the cut edge, whether counded or sharo

Cut Surface — Examine carefully the cut surfaces, noting colour, the outline of the lobules, irregularities in colour, etc. Next test the consistence of the liver substance by pushing the finger into it.

Pancreas.—The pancreas is best examined further by a series of transverse cuts. The fat in the neighbourhood of the organ should be examined for areas of fat necrosis.

The portal and spleric reins should then be opened up and search made for thromb. The lymph glands in the neighbour hood of the head of the pancreas should also be examined

Spleen—The spleen, which may be revoiced by itself or along with stomach and liner, should be explyed, its me noted, also any rough enting of its surface or thickening of its capsale, also irregularities in colour indicating infaires. Its consistence should be noted, and the organ opened by a long-tudinal incurion from its outer wiface to its failum. On the cut surface the general colour, the opperature of the Nalipsham bodies, should they be visible, and the existence of any tuberale modules or other opened areas should be noted.

All the organs have now been removed from the abdomen with the exception of the kidneys, the pelvic organs, and the large vessels

Removal of Kidners with Bladder - Note the position of the kidneys and the courses of the ureters The kidneys and suprarenals should be removed together. If here the existence of renal and bladder conditions is suspected, it is well to remove kidneys, ureters, and bladder together. This can be done by cutting through the blood vessels of the kidneys and dissecting down the preters to the brim of the pelvis. A cut is now made through peritoneum round the brien of the pelvis down to the bone, and by means of the fingers the bladder, pelvic colon, and, in the female, the genital organs are all separated from their attachments to the panetes, the vessels, etc being cut through close to the bone Green these organs with the left hand, pull them upwards and backwards, and cut through the urethra The point of the knife is then pushed down through the skin of the permeum close to the anus A circular cut is made round

the anal ornice and the group of organs is removed and placed in the sink

In the case of the male, when it is desired to retain the continuity between bladder and urethra, as in prostatic disease, cases of rupture of the urethra from fracture of the pelvis, etc, a special method of procedure should be adopted. The pelvic contents are freed from the bony wall as before. The original abdominal incision is then carried downwards for an inch or so along the penis. The penis is then cut through After freeing the pubic bones from skin and musicular attach ments the two rams are sawn through on either side. A little further dissection will enable the operator to remove the whole pelvic contents with the symphysis pubis and root of penis.

If it be desired to remove the female gential organs with bladder and rectum, a cut is made all round the birm of the pelvis through the pertoneum, this is separated as about by means of the fingers from the walls of the pelvis, the kind being used occasionally to divide vessels and nerves. The point of the kinife is next pushed down through the skin at one side of the perneum and, by an ellipical cut, the whole floor of the pelvis, including vulva and anus, is cut out. The pelvic organs can now be lifted out from above.

Suprarenals —Examine the two suprarenals by detaching them from the kidneys and making a series of transverse incisions

Bladder.—The bladder may now be opened by mserting the probe-pointed bistoury into the urethra and cutting upwards to the fundus. Note any enlargements of the prostate, ulcerations of the muous membrane, stone in the bladder, etc. Examine the ureters, and if necessary slit them up

If there is no obvious reason for keeping the kidneys attached, the ureters are severed at their commencement and the kidneys weighed

The kidneys may be removed by themselves either after the removal of the intestines, or, in cases where it is not considered necessary to examine these before the other visceria are touched. This is done by mylang a cut through the per toneum and fascia meeting the fingers, stripping the organ from its surroundings and pulling it forward. The vessels and ureter are then out through.

Kidneys - Note in the first place the size of the organs Examine the surface for pregularities and cysts, the more obvious irregularities of persistent feetal lobulation or old infarction, or the finer markings due to chronic interstitual nephritis Next incise the organ by cutting with the large kmfe from the outer border to the hilum (Fiz 13), in doing so, note the consistence of the organ Examine the cortex, noting its colour, its width, companing it with that of the medulla Look for the glomeruls, which may be seen as dark red Note any opaque lines or patches indicating fatty degeneration in the tubules. Look at the large vessels between cortex and medulla, and note any tortuonity of the interlobular ressels which run upwards from them into the cortex Lastly, note the amount of fat which is present between the kidney substance and the pelvis (peripelvic fat) and examine the pelvis itself

Then, taking the kidney in the right hand, grasp the capsule of the organ with a pair of dissecting forceps and timp it backwards. In a normal lidney this can be done quite easily, and the surface displayed is perfectly smooth. If the capsule is thickend and adversar, or if the surface is roof, the presence of c frome interstitial nephritis is certain. The appearance of the small cysis, so frequently found under the capsule under similar conditions, should also be noted. Note also whether small vinis (cent stellate) under the capsule are undely prominent.

Uterus and Appendages—The uterus is examined by making an incision into it from fundus to cervix, and transverse incisions along the upper border, so as to display the

openings of the Fallopian tubes. The ovaries are incised in their longest diameter.

Testicles — The testicles may be examined without muring the scrotum by moising the tissues at the external andominal ring and pressing the testicle upwards. The gland is opened by an incision in its longest diameter.

Thorace Duck, etc.—There only remain now for examina toon the large vessels, the thorace duct, the retroperstoneial glands, and the cocline ganglia. The inferior vena cava, aorta, and their branches are sht with scissors along their anterior walls and search made for thrombi and embol.

The thorace dust will be found behind and to the right of the norta. In the thorax it less to the right between the norta and the eaygos ven. It should be examined more especially in cases of military tuberations and its relation to any caseous lymph gland investigated

The semilunar ganglia will be found on the aorta around the rollac axis

EXAMINATION OF THE BRAIN

Scalp Incision.—Place a block under the nape of the neck to support the head Insert a small knile with its back to the skull under the skin immediately behind the right car, cut upwards and outwards to the vertex and from the vertex in the same manner down to a corresponding point behind the left car It is advisable to cut outwards in this way in order that the hair may not be cut off. It is well also, in the case of women, to separate the hair along the line of the incision, throwing part forwards and the other part hackwards. Raise a portion of the scalp by means of the hair and cut below it with the kinde. Then grasp the portion of scalp freed with the left hand, and, pulling forwards.

or backwards as the case may be, put the tissues joining scalp to skull and temporal muscle on the stretch, rendering the cutting of them more easy This should be done forward. nearly to the supracibary ridges, and backwards to below the occupital protuberance. In carrying this out, note the presence of any extravasation of blood below the scalp and examine the surface of the skull for fracture

Saw Cuts -Next, by means of an old knife, mark out the line along which the bone is to be sawn through In front, this line should run below the frontal eminences, and he carried back on either side, cutting through the temporal muscles to a point just above and behind the ears. Another cut starts from one of these points, and, making an angle of about 160° with the former cut, runs across the back of the skull a little in front of the occipital protuberance to the corresponding point on the other side

Next, standing on the right side of the body, take a dry towel and throw it over the skull, place the left hand on the towel and through it grasp the calvanum, throwing the anterior portion of the towel over the back of the hand Take the saw in the right hand and commence to saw through the outer table of the frontal bone, following the previously mentioned lines as closely as possible. The saw-cut should be carried nearly, but not quite, through the inner table, in order to avoid injuring the membranes and brain When a fracture is suspected, however, it is well to carry the sawcut through both tables Then, taking the hammer and chisel, insert the edge of the latter into the saw-cut, and, by a series of sharp taps, crack through the remainder of the inner table It is well to tilt the chisel slightly, so that the angle of the instrument enters first.

Removal of Calvarium.-The next step is to pull back the calvarium by means of the book on the cross-piece of the chisel, at the same time separating the dura from the bone with such an instrument as a periosteum separator. In the case of old people, alcoholics and also young children the dura may be found too firmly adherent to the bone for this. In such a case the dura should be divided all along the saw cut and removed at the same time as the calvarium linese the superior longitudinal sinus and examine for clots or thrombi.

Dura Mater—With a pair of dissecting forceps pick up a portion of the dura mater anteriorly and messe it Insert a probe pointed bistoury into the opening and cut round the dura on both sides, at the level at which the skull was sawn through. Insert the kinds between the left frontal lobe and the falx cerebr with the edge towards the falx Cut through the latter and pull back the dura mater. The dura will usually he found adherent over the vertex by means of vessels and Pacchonan bodies.

Brain Surface — Examine the exposed surface of the brain, noting its vascularity, any flattening of the convolutions, or filling up of the sulci with exudate or blood

Removal of Brain—Insert two fingers of the left hand under each frontal lobe and gently pell the brain hack Detach the olfactory bulbs from the errbriform plate with the handle of the kinde. Cut through the optic nerves and the unternal carotid vessels as near the bone as possible. Cut through the 3rd, 4th, 5th, 6th, and 7th nerves. Cut the tentorium cerebelli along its attachment to the petrous persion of the temporal on either side (Fig. 11). Divide the 8th and 9th nerves. Pass the bistoury down the cord and divide it obliquely as flow down as possible. Sever the two vertebral arteries and a few nerve roots and the brain will tilt back into the left hand.

Cerebro-spinal Find.—During all this process, cerebrospinal fluid will escape Note the amount and character of this fluid, whether clear or opaque, and, if necessary, secure a specimen for further examination

Base of Skull.—Either before or after the examination of the brain, the base of the skull should be further investing the state of the skull should be further investing the state of the skull should be stated on the state of the skull should be stated on the skull should be stated on the skull should be skull should

Examination of Erain —The brain should now be irreghed and its surplese further examined. Note the condition of the restell, more particularly those at the base, looking for opaque areas of atherona, thrombs, or small aneuryms. Note thickening or opacity of the pia arachnoid. Examine for exudate in the substracthoid space, more particularly at the base of the brain. Examine the Sylvan fissures on either side for small tubereles along the lines of the vessels. Pass the fingers carefully over the whole surface of the organ, noting the presence of any area of exceptional softness.

The method of proceeding further with the examination of the brain depends to a great extent upon the pathological condition present. In a large proportion of cases it is addisable to fix the organ before cutting it up. This is done by impeting 10 per cent formalin, or Pick's or some other preservative, into the larger vessels at the base, placing the whole organ in similar fluid, padding the jar, in which it is suspended by means of a piece of string run through the basilar artery and attached to the lid of the jar, with cotton wool, and leaving it there for some days at least

Section of Brain.—When it is necessary at once to examine the whole organ, it should be placed vertex down wards and the pons and medulla removed by cutting through the crura cerebri. The cerebrum is then placed upon its

base, and with a large and sharp kinde a series of horizontal sections are made at intervals of half an inch, commencing at the vertex, the organ being steaded by means of the left hand placed flat upon it. The pons and medulla are then opened up by means of a series of transverse cuts and the cerebellum examined by an incision from its posterior border to the peduncles. Search is then made on the cut surfaces for Americage, time transition, time transitions, tet

EXAMINATION OF THE SPINAL CORD

Removal of Spinal Cord.—Turn the body over on the face, with the head hanging well down over the end of the table. Make an incision through the slim over the spinous processes from the occiput to the sacrum. Cut the muscles through on either side down to the laminae, pulling aside the muscles from the spinous processes. Then saw through the laminae on either side about one half inch from the middle line, directing the edge of the saw slightly inwards. It is unnecessary to saw below the third or fourth lumbar vertebra, as the cord does not reach farther than the second lumbar A rough rugle for the lower end is the creat of the lumb

Having partially sawn through the laminæ, complete the process with the hammer and chisel, taking care not to damage the cord Lift up the spinous processes thus set free at some point, and then, with the bone forceps, proceed to bite through the remainder of the laminæ on either side, filting up the spinous processes as you proceed. This should be done above as high as the atlas and below as far as the 3rd or 4th lumbar. Free the cord at the lower end by cutting through the nerve-roots and the dura, then, holding dura and cord, cut through the nerve-roots upwards, if necessary removing the gangla with the roots

At the upper end of the cord cut through the dura from above, 12 through the foramen magnum, and remove the

whole cord Next lay the cord on a flat surface, ucuse the dura anteriorly, and preserve the cord in the first instance in to per cent formalin. After two or three days make a series of transverse cuts, dividing the cord into a number of segments which remain attached posteroody to the dura. Subsequently, thunner portions may be placed in Muller's, Marchi's, or other fivative.

In cases where it is desirable to retain the continuity between brain and cord, as in cases of lesions of the cervical region, the cord should be exposed first and all the nerve roots severed. The dura mater of the upper portion of the cord is cut through from above, also the upper nerve-roots, and if desired the cord at the level of the foramen magnum may be exposed by taking a wedge-shaped piece of bone from the back of the skull. The cord will now come away with the brain.

Eye and Orbit.—The eye and contents of the orbit may be examined by chaping through the orbital plate of the frontial and removing the pieces of bone with a pair of bone forceps beginning at the optic foramen. The posterior half of the eye can then be removed by making an equatorial cut with a pair of sharp-pointed seissors without damaging the appearance of the face.

Middle Ear—The middle ear and mastoid antrum can be readily examined after stripping the dura from the base of the skull, by chipping off the upper surface of the person portion of the temporal bone with a chizel, or by merely opening through the fine tegmen tympain. For more careful examination it will be necessary to remove the petrous portion of the temporal entire and decadedly it in bulk, afterwards cutting it up (Fig. 12).

Other Accessory Cavities.—The frontal, ethmoidal and sphenoidal sinuses can be opened up by chipping away portions of their bony walls (Fig. 12)

Another method is, after stripping the dura, to make a saw-cut (Harke's) through the base of the skull in its sagittal diameter a little to the right of the middle line (Fig. 12), care having been taken in the first instance to dissect the anterior flap of skin down to the root of the nose, the posterior well down behind the occuput making the saw cut the hard palate and two upper cervical vertebræ must be severed, and great care must be taken not to injure the external surface of the face The two halves of the skull can then be separated and the right frontal sinus, the ethmoidal labyrinth, and the sphenoidal sinus examined The nasal cavities can be examined at the same time

In all cases of meningitis careful examination should be made of the cavities in the skull

The maxillary antrum is best opened by lifting the upper lip, dissecting upwards and subsequently chiselling through the bony wall of the cavity

Summary of Steps in Method of Procedure

- 1 External appearances
- 2 Primary incision reflection of skin and muscles removal of stermm
- 3 Examination of serous sacs pleura, pencardium, peritoneum
 - A Removal of contents of thoracic cavity, examination of (a) Œsophagus

 - (b) Larynx and trachea
 - (c) Aorta
 - (d) Pulmonary artery
 - (e) Heart
 - (f) Lungs
 - (e) Mediastinal contents
- 5 Ligature of intestine at junction of duodenum and tetunum, and removal of whole intestinal tract

- 6 Removal of stomach and duodenum, liver, spleen and pancreas, and examination of these in detail
- 7 Removal of kidneys, suprarenals, ureters, and, if necessary, of the bladder in continuity with these
 8 Removal and examination of privic contents and
- 8 Removal and examination of pelvic contents and testicles
 - 9 Examination of abdominal aorta, etc.
 - 10 Opening up skull, removal and examination of brain
 - 11 Examination of base of skull and accessory cavities
 - 12 Removal of spinal cord
- 13 Examination of peripheral nerves, bones, joints, vessels, etc.
 - 14 Opening and examination of intestine.

LETULLES METHOD

After the preliminary incision and the removal of the sternum, the floor of the mouth is cut through close to the jaw, and the tongue, pharyax, tonsils, larynx, cesophagus are dissected down along with the caroud arteries, jugular veins, thyroid and lymphatic glands The pleurie are then examined Should there he no adhesions present, the left lime is drawn over, the operator standing on the right side. The pleura is then cut through longitudinally where it is reflected from the vertebrae on to the lungs and mediastmal contents. The intercostal arteries are then cut through and the esophagus and other contents of the posterior mediastinum detached from the prevertebral fascia by pulling gently. The same thing is then done for the right pleura, the operator standing on the left side, care being taken in this case not to injure the thoracic duct and the vena azygos major The brachial plexus and the subclavian arteries and veins are then cut through at the inner margin of the first rib, and the whole contents of neck and thorax are free In cases where there are extensive firm adhesions between parietal and visceral pleura it is necessary to tear away the panetal pleura from the ribs and intercostal muscles by means of the fingers The attachments

of the disphragm are then cut through, taking care not to injure stomach or liver. The whole of the parietal pertoneum is then stripped, along with the abdominal contents, tocluding kidneys, vessels, etc., leaving only the psons muscles. The hlac vessels are cut through as low down as possible. The pertoneum is stripped from the sides of the pelvis, the skin is cut through round the anal orifice, and the whole of the viscera removed and placed upon a dissection table.

The examination of the parts in detail commences by placing the viscera with their posterior aspect upwards and opening the venæ azygos major and minor and the thoracic duct. The suprarenal glands are then removed and examined. The ureters are isolated and opened, the kidneys removed and examined. The north and the inferior vena tava are then opened throughout their length. The trunk and rootlets of the portal vein are isolated and opened up and the common bile duct examined The aorta is then dissected away from other structures and the cesophagus and cardiac end of the stomach isolated The tongue, pharynx, and tonsils are then examined and the exophagus, trachea, and bronchi opened up The yagus and other nerves and the happh glands of the neck are investigated. The viscera being turned over, the thymus and thyroid glands are examined. The superior vena cava and its tributaries are then opened. Next, the pencardium is opened, and the first part of the norta, the pulmonary artery and veins and their branches outside the lungs are opened up. The heart is next examined externally and removed from its attachments. The lungs are also detached and examined. After examination of the diaphragm. the liver and its bile passages are investigated and detached. also the spleen Next, the stomach, pancreas, and duodenum are isolated and, along with the ecsophagus, removed, opened up, and examined The intestinal canal is then examined from the outside, detached, opened, and investigated in its various sections. The examination finishes with the penital organs and urmary bladder

SHENNAN'S METHOD

The organs are removed in the following order -

- (1) Small intestine,-with or without-
- (2) Large intestine.
- (3) Stotnach and duodenum, with liver, bile ducts through out their whole length, pancreas, spleen, and mesentery
 - (4) Kidneys with suprarenals and greters.
- (5) Thoracic contents along with the cervical soft structures, the aorta in its whole length, inferior vena cava, crura of the diaphragm with solar plexus and receptaculum chyli.
- (6) Pelvic organs, which in Certain cases may be removed in continuity with large intest ne, and ladneys

Stitching up Incisions Toilet of the Body —After the completion of the examination it is absolutely essential that the body be restored as nearly as possible to its original condition.

In the first place all fluid should be got rid of by tilling the body or by swabbing out the cavities with \$ponges The organs are then replaced and sawdust, wool, tow, or newspapers used to compensate for the loss of fluids, etc. Firm plugs of wool are then placed in the mouth, anus, vagina, etc., in order to prevent the escape of any fluids.

The skin incisons are closed by means of the gloter's or blanket stutch, a packing needle and strong twine being used In carrying out this procedure the needle is always passed from within outwards, the slack of the twine being held firmly between the fingers of the left hand (Fig. 14) The stutches should be about half an unch apart.

Finally, all trace of blood is removed from the surface of the body by sponging and subsequently wiping with a towel

Gleansing of Gloves and Hands—After completing all operations in which the hands come in contact with the body or its contents, the gloves, while still on the hand, should be washed in cold unuang water, at first without, then with soap Subsequently they are washed in banodide

of mercury spirit or merely in methylated spirit. They are then removed from the hands, and if any leakage of blood or other fluid has occurred the interior should be treated in a similar fashion

The hands are then thoroughly washed with soap in cold running water.

NOTE—In cases where injury to the skull is suspected it is well not to use the chisel and hammer but to saw through the entire thickness of the skull at the risk of damaging the dura.

Instead of adopting the two saw cuts at an angle of 160° many pathologists make a continuous circular cut. The advantage of the two cots is that the calvarium remains in nosition better after the scalo has been stitched.

It is usual not to attempt to replace the brain within the skull but, after plugging the foramen magnum with a small piece of wool, to pack the cavity lightly with wool, tow, or crumpled paper, and then fit the calvarum on.

CHAPTER IV

DISEASES OF THE HEART AND PERICARDIUM

MALFORMATION OF THE HEART AND GREAT VESSELS

The heart is developed in the first instance as a single tube, with primitive aurole, ventricle, and acrite bub. The structure later becomes bent upon itself and stell about a real mind litter divisions, so that eventually there are two auroles, two tentricles, and two vessels—the aorta and pulmonary artery. The commonest congenital malformations of the heart are associated with defects in the formation of these septia.

- 1 Defective Interacticular Septum.—A degree of this, i.e slight patiency of the foramen oxide, is a very common occurrence (30-50 per cent of eases). In the last majority of the cases, owing to the smalleres of the aperture and to its oblique detection, there is no interference with the function of the organ. In cases of stenoss of the pulmonary artery or aorta, however, the defect in the septum may be marked.
- 2 Defective Interventricular Septum.—The separation of the ventrole into two begins near the sper. The septum rises towards the base. The last portion to form is the portion represented by the "undefended spot" in the

fully developed heart. It is at this point that defects in the septum most commonly occur. As in the case of defective interaincular septum, potency is usually associated with defects in the vessels, most commonly with stenosis of the pulmonary artery. Complete absence of the septum results in the so-called three-chambered heart.

- 3 Congenital Stenosis of the Fulmonary Artery— This is one of the commonest congenital defects and its existence leads to a number of others—defective inter auricular and interventricular septa and patency of the ductus arteriosus. The narrowing may occur at the valves or in the artery beyond the valve. The cause may be (1) malformation of the septum dividing pulmonary artery from aorta, the septum being found too far to the right (2) Fetal endocarditis. All degrees of the condition to complete obliteration or atresia may be found
- 4 Obigenital Steuesia of the Aorta—This is much more rare than the preceding condition. Again, it may occur at the valve or in the vessel beyond. When it occurs at the valve there is usually defect of the septa superadded Stenesis of the vessel beyond owing to the persistence of the ductus artenesis, is not of so much importance, the circulation being carried on through the latter vessel. Stenesis is sometimes caused by a circular fibrious band at the point where the ductus artenosus joins the aorta.
- 5 Pernstence of the Ductus Arteriosus or, in other words, patency in extrauterine life of the communication between the pulmonary artery and the thoracic aorta accompanies other defects, such as narrowing of the pulmonary or aortic orifices.
- 6 Abnormalities in the Valves —These mostly occur in the semilunar valves (a) There may in the first place be complete fusion of the segments leading to stenosis (b) There

may be only two cusps, a large and a small one, the larger m some cases showing evidence of partial division into two (2) The segments may be sharmanily numerous. There may be four instead of three, and all differing in size (4) The segments may show fensionations. This is a common occurrence, but as the openings are usually close to the free margin and as the area of contact of the segments extends some distance from the free margin, there is no incompetence of the value as a result.

Of congenital anomalies of the auriculo ventricular valves the commonest is coalescence of the segments of the pricupped valve. This may be due to foctal endocarditis. It leads to patency of the foramen ovale.

7 Abnormalities in the Great Vessels—There may be possiposition of the sorts and pulmonary artery, so that the latter takes origin from the left ventrole, the former from the right. Occasionally a double corta is met with—a condition found normally in repulse. Or the corts may pass to the right, the condition found in birds.

The heart may be set atted to the right side of the body. This may or may not be associated with transposition of the other viscers. Occasionally the persearchal see is obsent and the heart may be sthated in the abdomen electrons cortice.

DISEASES OF THE PERICARDIUM

Under the term feromentum are included [4] the sac formed of fibrous tissue, transpalar in shape, whose has rests upon the daplargun, and whose sides are attached to the pleure laterally the lower points of the sterrum antenoty, and the mediatrium's posteroidy, (2) the serous endothelial lung of this figurated prenardum which is reflected on to the surface of the beart fysiceral pencardium or epicardium), and (3) the subsectors connectine tissue and fat. No hard and fast line can, of course, he drawn between discussed conditions of the epicard un and those of the myocard um. If one is affected, the other of necessity must he For purposes of classification it is necessary, however, to draw a distinction between them.

After the removal of the sternum and costal cartalages the position of the pencardial size and its contents as regards the other structures in the thoracic cavity should be noted, also any abnormal distention of the sac. The pencardial sac is, of course, one of the serous seas or large lymphatic spaces of the body, and as such it is hable to conditions which tend to affect these sacs. Such are eddema or over filling of these spaces with lymph, inflammatory conditions, more particularly in acute theumatism.

Hydropericardium, or dropsy of the sac —There is nlways a small quantity of clear, straw-coloured fluid in the sac (about ½ oz). When this is increased to any extent the term dropsy is applied. The condition is usually a late namifestation of general dropsy, the cause being commonly kidney or heart disease. Edema of the tusues of the pericardium themselves may not unrequently be observed, either accompanied by droppy of the sac or without it.

Hemopericardium, or blood in the sac—This is a very rare condition. It may be due to (i) a printialing wound—builet wound or stab, (ii) ruphure of the heart from (a) degenerative changes in the muscle associated with obstruction to the coronary arteries (common position, it he anticorraspect of the left ventricle close to the septum and not far from the apex), (b) abscess of the beart wall communicating with one of the cavities (Fig. 16), (c) impur—a crush (common position, base of heart), (iii) ruphure of an anisary mot the heart itself, of one of the commonary arteries or of the commencement of the aorta, (iv) very acute inflammation of the renerardial such

Small extravasations of blood into the substance of the subperscardial tissue (ecchymoses or petechial hæmorrhages) are fairly common. They are found in toxic conditions and

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in severe anamias. They are chiefly situated at the base of the beart, and often on the posterior aspect.

Pneumopericardium, or air in the sac—A very rare condition, usually associated with purulent pericarditis due to rupture of the ectophagus or stomach into the sac. The gas may be due to the presence of germs, e.g. B aerogenes consulative.

INFLAMMATION OF THE PERICARDIUM (PERICARDITIS)

Types

r Acute pericarditis

(a) Fibrinous, (b) serous, sero-fibrinous, (c) puru lent, (d) hæmorrhagic.

- 2 Chronic pencarditis, (a) following acute, (b) "milk spot"
- 3 Adherent perscardium
- 4 Tuberculous penesiditis

I Acute Percarditis.—This is due invariably to the presence of some germ. Those more commonly found are mirreacceus themselves, in the presence, premise occ., etc. The condution occurs in the course of acute rheumatism, pixemia, paetimonia, kidney disease, the organisms reaching the percardial sac by the blood or by continuity of issue from lung, pleura, mediastinum, or heart wall.

The essential point in pericarditis is the presence of an exudate on the surface of the pericardium which coagulates, thus roughening it and causing it to lose its gloss. The amount of this exudate may be very small, forming a mere roughness on the surface, or at may occur as no irregular, thick, opaque, white layer producing a shaggy appearance (cor rillorum) (Fig. 15). If the pericardial surface is visible the vessels are seen to be impeted. The exudate may be

red in colour from hamorrhage. The amount of fluid in the sac in this condition is variable. Sometimes it is small, lorning the so-called "dry," plastic, or fibrineus variety, found more especially in kidney disease and in pneumonia. More commonly there is some free fluid with fiakes of lymph floating in it in such a case the term "srows" or "sro-fibrinous" may be applied. In some cases the fluid is purulent, more especially in pyrenia or septicemus. Occasionally, in intense inflammations, blood in considerable amount is mixed with the exudate (hemorrhage: presentable to moved. Later on, when organisation has commenced, it will be found bound down by fine threads which represent neutrating voune blood vessels.

Microscopic Appearances —The vessels of the subpencardial tissue are dilated. There is a meshwork of fibrin on the surface of the percardinin, and some in the spaces of the tissue itself. Numerous leucocytes (chiefly polymorphonuclear) are found infiltrating the percardial tissue and caught in the meshes of the fibrin on the surface. In the early stages the endothelial cells are swolfen and vacuolated, later they become detached and occur in the fibrin.

Later on, evidence of organisation of the exudate is found. The endothelial cells of the vessels of the subepicardial tissue are swollen and show evidence of proliferation. Small huds can be seen proruding from these vessels and making their way into the fibrinous exudate. At the same time there is swelling and proliferation of the councetive tissue cells generally the newly formed cells (fibrioliats), which are at first small rund rounded, with a fur amount of pale staining protoplasm and a rounded, etainty small nucleus accompany the newly formed vessels into the exudate. Where organisation is advanced, the fibrioliats starthest from the percardium will still be rounded, the deeper ones will be spindle shaped and arranged parallel with the vessels, still nearer the percardial surface they tend to be parallel with that surface and perpendiculate to the discretion of the new blood vessels. From the

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protoplasm of these older fibroblasts the collagenous fibres of the new tissue are developed

In suitably stained specimens micro organisms may be found.

Results (1) the exudate may be absorbed, and matters return to the normal

(2) Organisation with union between heart and pericardial sac may take place (Adherent Pericardium). This union may be partial or complete. If complete, more especially if the surrounding tusies of the mediastinum participate in the inflammatory process, great interference takes place with the action of the heart, with the result that it tends to dilate.

(3) If the exudate be not absorbed it may be the seat of deposit of lime salts, the result being the formation of calcarrous plates. This is a tare occurrence

a Chronic Percarditis—This may follow acute, or it may develop slowly, the result of friction (a) Following acute, the condition is trustilly associated with adhesion between visceral and partial percardium (b) A more common variety of it comists in the fibrous thickenings of the percardium, often called "milk spots" or "soldier's spots". These are white, opaque, well-defined areas, often with a tendinous appearance. They are most frequently found on the antenor surface of the right ventricle close to the apex. Similar areas are often found thickly covering the surface of the auricles. They are also not interquently found along the course of the coronary arteries. They are more particularly found in hypertrophied and dilated hearts, and are due to constant fraction.

Microscopically all that is to be seen is a thickening of the fibrous tissue under the endothelium.

3 Adherent Pencardium.—This condition not infrecuently follows acute fibrinous pencarditis. The layers of fibrin on visceral and parietal pencardium become organised. Young connective tissue forms between these layers, and the heart is permanently attached to the pericardial sac. This may occur over a limited area, frequently at the apex of the left ventricle. Very often, however, it occurs all over. The inflammatory change may also spread to surrounding structures, such as pleura, mediastinum. The mediastinal glands are enlarged and firm. In this condition the heart is usually enlarged, the cavities being dilated and their walls thickened. There is backward pressure from relative incompetence of the valves, and chronic venous congestion of the organs, such as lung, liver, and spleen. The condition not infrequently causes death from constant excessive strain on the heart.

4 Tuberculous Percardits —This may occur as a subacute condition associated with the presence of small grey
and yellow nodules of tubercle. It is often combined with
general miliary tuberculosis. Sometimes the tubercle nodules
are found along the course of the coronary vessels without
any other evidence of inflammation heing present, and sometimes there is excessive distention of the pericardial sac by
fluid, and a thick layer of fibrin may cover the heart and lime
the sac. The true nature of these latter cases may not be
recognised until microscopic sections are examined, when
the characteristic focal aggregations of epithelioid cells with
occasional giant cells clinch the diagnosis. Tuberculous
pericarditis is, however, a rare condition in the human
subject. It is relatively much more frequent in the bowne
species.

DISEASES OF THE MYOCARDIUM

DEGENERATIVE CHANGES

Atrophy -- In old age and in wasting diseases, such as tuberculosis and cancer, the heart tends to get smaller,

sometimes being reduced to one-third of its usual size. As the process goes on the epicandium which does not participate in the shinkage, becomes winkled, the vessels more tortuous, and the fat under the epicardium reduced in amount. At the same time the muscle substance becomes a darker brown colour. This condition is known as brown alrephy. The brown colour is due to the increase of the pigment found normally in the muscle cells and is probably a coloured fat or incordium.

Heroscopically the individual fibres of the myocardium are sometimes smaller than normal but the main change is an increase of the golden yellow granules of p geneut which are found in small amount normally at the two poles of the nucles.

Cloudy Swelling —This condition is found accompanying infective diseases, more especially those associated with high temperature. The muscle substance is pale, soft, and finable. The finability can be tested by pushing a finger into the muscle.

Microscopically there is often very little alteration to be seen. The individual fibres are somewhat swellen and granular, and there may be some loss of longitudinal and occasionally of transiverse strution.

Fatty Changes -Types.

- t Due to increase in the subperscardial fat
 - (a) Fatty loading
 - (b) Fatty infiltration
- 2 Due to degenerative changes in the muscle fibres (fatty degeneration)
 - (a) Diffuse form
 - (b) Patchy form

I Fally Loading and Fatty Infiliration —This condition comes, strictly speaking, under diseases of the pericardium, but for the sake of contrast with fatty degeneration it may be taken here

There is in all healthy learts a certain amount of fat in the subpericardial tissue, more especially in that covering

the right ventricle. It occurs particularly along the lines of the vessels and at the base between the auricles and ventricles. In very fat people this adipose tissue is increased in amount. so that not infrequently the whole of the anterior surface of the right ventricle may be covered by it. This is what is known as fally loading of the heart The increase of fat may also occur in anamia and in association with atrophy of the heart muscle

As the fat increases in amount it tends to make its way along the lines of the vessels which penetrate into the muscle substance, leading to indistinctness in the line which separates fat from muscle When this has occurred, the term fatty infiltration is applicable (Fig. 18) The fat in this way tends to separate the bundles of muscle substance from one another, and to cause an atrophy of these by pressure This fatty infiltration of the heart often accompanies fatty loading, but it may occur where there is relatively little increase in the amount of subpencardial fat

Microscopically, the rounded fat globules can be seen passing down from the subperscardial fat along the lines of the vessels into the muscle substance. The muscle fibres themselves are compressed and atrophied.

2 Fatty Degeneration -This is a totally different condition from the preceding. It is a degenerative change in the muscle fibres themselves It is found more especially in toxic conditions, such as alcoholic or phosphorus poisoning, bacterial diseases, and in severe aniemias. Two forms of it are distinguished (1) a diffuse form, where the whole muscle substance is uniformly pale, soft, and fnable, (2) a patchy form, which is usually best seen towards the inner portion of the wall of the left ventricle, more especially in the papillary muscles In this position the muscle has a mottled appearance, with small transverse parallel patchesthe so-called "thrush breast" mottling or "tabby cat" striation "Tigering" and "faded leaf appearance" are also descriptive terms which have been applied

Microscopically groups of muscle fibres are found contain ing numerous small droplets of fat in the r protoplasm. There is at the same time some loss of striation both transverse and longitudinal

Fragmentation and Segmentation of the Heart Muscle—This is a condution sometimes seen in old people, also in acute and chrome infective conditions, in diseases of the central nervous system, and in sudden death from various causes. It does not necessarily give rue to any gross changes although cloudy swelling is often associated. In such cases the muscle is soft, finishle, and somewhat people. The chief change is found on microscopic examination when the muscle cells are seen separated from one another by gaps—segments ton—or, it may be, broken across within the fibrous sheather fragmentation. It is doubtful at present how far these changes are aronal or possibly even due to post morter changes.

Calcateons Degeneration.—Deposit of calcium salts may occur in an area of nercord muscle following unfarction A ring of calcareous deposit is sometimes met with in aged individuals in the myocardium close to the attachment of the mitral valve. The mitral valve is itself usually also thickned and the muscle around is fibrosed. Owing to its situation this ring of degenerated muscle may involve the bundle of His Calcafraction of unabsorbed exudate in the pericardial sea has a legardy been mentioned.

ALTERATIONS OF THE CIRCULATION

Chronie Venous Congestion.—This occurs in conditions where there is backward pressure on the right aurice and therefore on the blood in the company sains. It is accompanied by chronic venous congestion in other organs. The muscle substance is firmer and thicker than usual and is dark in colour, and usually has a transfurent look from e-dema.

Microscopically there is excessive distension of the veins and capillaries with blood

Effects of Obstruction of the Ooronary Arteries on the Myocardium —The branches of the coronary arteries within the heart belong to the group of what were originally called "end" arteries. They are not as a matter of fact entirely decood of collateral communications, as the name would indicate, but such communications as the phave are small, so that when a branch is blocked the circulation cannot be fully restored, and infarction occurs. The effect of the obstruction of these branches upon the heart depends to a large extent upon whether it is sudden and complete or whether it occurs slowly, and is therefore, for some time at any rate, partial.

1. The effect of sudden obstruction of a large branch of one

of the coronary arteries is, as a rule, to produce instant death. When the branch is a small one and the patient survives, infarction occurs. The cause of the obstruction is criefly thrombosis upon an atheromatous patch in the artery or impaction of an embolus. More usually it is the former. In all cause of unexplained sudden death careful search should be made for such thrombs by slitting up the branches of the coronary testels.

The infarcted area is commonly in the antenor wall of the left ventrule, in the part of the myocardium, that is to say, supplied by the left coronary artery. The area is roughly triangular in shape, with the broad base towards the intenor of the ventrule. It may be red or pale. In the early stages it is usually red, becoming pale later on, as necrosis supervenes. Ultimately connective tissue develops, and all that is left is a fibrous sear.

Owing to the weakening of the muscle at the point of infarction, aneurysmal dilatation of the wall may occur, or even sudden, complete rupture

Microscopia Affeorances—In the early stages the muscle is found infiltrated with red blood corpuscles. The muscle fibers are swollen, have lost their transverse stration, and stain deeply. The model fose their stain ng reaction. Later, the area becomes infiltrated with becocytes and young connective tusine cells. The degenerated fibres are absorbed and connective tusine cells.

a Slow Progressive Narrowing of the instinate from atheromatous change. It leads to degenerative changes of a fatty nature in the muscle fibres of the area supplied, and a gradual replacement of these by well-devoloped fibrous issue. As it is the anterior of descending branch of the left coronary artery which is usually the seat of the most marked change, the fibrous occurs in the wall of the left ventrade near its apex, in the papillary muscles (Fig. 17), and in the interventineular septum Owing to the weakening of the heart will, rupture or aneury smal dilatation may occur. The change produced is precisely the same as that descended under chemic interstitual myocardistic. Indeed, slow progressive narrowing of the branches of the coronary artery is the commonest cause of that conditions.

Ancaryam of the Heart—This is most frequently met with towards the apex of the left ventrule. The causation in such cases is usually progressive nearrowing of the descending branch of the left coronary artery. The connective tussue which takes the place of the degenerating muscle is unable to withstand the pressure within the ventrule. The condition may also dee loop acutely from infraction of the beart muscle or acute myocarditist (Fig. 16). On the inner aspect of such dilutations, thrombous tends to occur An ancuryam of one of the snoses of Valsalva may also penetrate the heart muscle. On the inner aspect of such dilutations the endocardium undergoes fibrous thickening and thrombous tends to occur.

INFLAMMATION OF THE MYOCARDIUM (MYOCARDITIS)

Types

- r. Acute myocarditis
 - (a) Non suppurative, (b) suppurative
- 2 Chronic interstitual (fibrous) royocarditis
 - (a) Following acute, (b) associated with narrowing
 of the coronary arteries, (c) due to chronic
 inflammatory conditions (tubercle, syphilis)
- I Acute Myocarditis —This may be due to (1) spread of inflammation from the pericardium or endocardium, or to (2) blood infection, as in acute rheumatism, ulcerative endocarditis, pyremia, etc. The muscle substance may show little alteration from the normal I is somewhat soft, finable, pale, and mottled In the special type—suppurative myocarditis—small abscesses are seen as minute white points surrounded by zones of congestion and hemorrhage. Very occasionally large abscesses may form which lead to rupture of the heart (Tig. 16)

Microscopically the muscle substance is found infiltrated with leucocytes, more especially in the neighbourhood of vessels. The leucocytes may be aggregated into large masses, with hemorrhage around and plugs of cocci in the centre of the abscesses. The muscle fibres themselves show cloudy swelling, or, in the neighbourhood of abscesses, actual necrotic change

2 Ohronie Interstitial Myocarditis—In this condition there is a replacement of the muscle substance by fibrous tissue it may (1) follow acute myocarditis, (2) be associated with narrowing or obstruction of the coronary artery or its branches, (3) occur in connection with chronic inflammatory diseases, such as tubercle and syphilis The comments course includiblely narrowing of branches of the coronary artery A

slight degree of the condition is often seen in old age due to the same cause

The condition is usually most marked in the reall of the life tentricle rear the after. It should also be sought in the fapilitary muritis. The muscle substance in these areas is partially replaced by white or grey fibrous strands (Fig. 17). The endocardmun is often thekened over a corresponding area and thrombosis is frequently associated. The condition may give rise to aneury small dilatation of the heart wall. It follows from the above noted distribution that the dilatation occurs most frequently at the apex of the left ventrale.

Microsofycelly the groups of muscle fibres are found separated from one another by bands of well-developed fibrous ussue. The soluted muscle fibres are often unusually large, with large, dark stanning nucles. Such may solicate an attempt at hypertrophy. Following acute theumaisim sepecially, collections of cells are often found which have been called "Aschoff bodies." These occur more particularly in the posterior wall of the left ventricle near its base. They are elongated aggregations of endobeloid cells, some of them very large and conspiccous. They often occur in immediate relationship to essels and may be accompanied by polymorphis and consciptions of the section of t

Styphilis of the myocardoum is occasionally met with either as gumma formation or as a diffuse intertuital myocarditis associated with arterial disease. Some ascribe the more extensive scars, often with aneutysmal distention, to the results of a previous gummatous process. Gummata may occur in the interventricular septum and thus implicate the bundle of Ilis.

Tuberculosis of the myocardium is also a very rare condition. It may be met with as small miliary tubercles or as large caseous masses The miliary tubercles appear as grey translucent spots They are very rare in the heart, and if met with usually occur in the pericardium The caseous masses are yellow with grey margins Such are excessively rare

HYPERTROPHY OF THE HEART

A general hypertrophy of the heart occurs in those, such as athletes, who constantly over-evert themselves. It also occurs in pregnancy. Hypertrophy of one or more chambers of the heart is usually associated with chromic valvular lesions. Conditions, other than cardiac lesions, associated with hypertrophy of certain cavities are emphysema and chronic interstitial disease of the lungs with hypertrophy of the tright ventricle, chronic kidney disease, and arteriosclerosis with hypertrophy of the tright ventricle (Fig. 2a)

DILATATION OF THE HEART

General dilatation of the heart is found in association with degenerative changes, such as cloudy swelling, fibrous myocarditis, and fatty degeneration. The dilatation is usually most marked on the right side. In adherent peri cardium of any marked degree the heart as a whole tends to dilate.

Dilatation of the right side is found as a rule in cases of death from heart failure. It also occurs in chronic valvular disease involving the mittal or aortic valve. Dilatation of the left ventrale associated with hypertrophy occurs in a marked degree in cases of aortic incompetence. Localised dilatations are known as aneurysms. They are usually met at the apex of the organ.

Tumours of the heart are excessively rare Primary tumours such as fibromata or myomata are described

Secondary tumours—saxomata and carcinomata—occa ionally occur, but may involve the heart very extensively before they result in death. The commonest of these secondary involvements is an extension of a mediastinal tumour, usually a saxoma.

DISEASES OF THE ENDOGARDIUM

DEGENERATIVE CHANGES

Red staining of the endocardium, heart valves, and vessels occurs post mortem as a result of putrefaction processes. It is always marked in cases in which a post mortem is performed some days after death. It may also be found soon after death in cases which have died of septic conditions. It is due to the setting free of himmoglobin from the red blood cells.

Small hamorrhages may occur under the endocardium in infective conditions and in severe anarmas.

Areas of fatty degeneration occur as white speeds or patches, more especially in infective conditions, in anomials, and in cases of phosphorus and chloroform pousoning. These areas occur chiefly on the valves. Under the microscope the protoplasm of the endothelial and of the subjacent connective-tissue cells in found falled with fat globules.

Calcarous and uratic deposits are found more especially in the valves, and chiefly in association with chronic influm mation. They appear as opaque white or yellow areas of thickening, sometimes with a roughened surface, on which thrombit may be deposited.

Atheromatous change both the early stage with thicken ing of the endocardium and fatty degeneration and the later stage of calcification, may be found, more especially

as an extension from the aorta. There is no hard and fast line between this condition and the fatty change already mentioned.

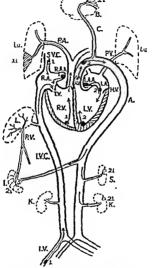
Fibrous thickening of the endocardium is common in relation to chrome endocardium cocurring in the valves themselves, the endocardium close to the attachments of valve segments, and in the chordse tendines: Apart from endocarditis it is met in association with fibrous myocarditis, aneurysm of the heart wall, and infarction, the area of fibrous thickening being white and opaque and corresponding in distribution to the diseased area of heart muscle

CLOTS IN THE HEART

Thrombi are clots formed within the heart or the vessels during life. In the heart they form chiefly where the blood current is slow or where there are eddies. These conditions are present more especially in the auricular appendies. The commonest site for thrombi is the right auricular appendies (Fig. 19). Thrombi also occur in the ventricles towards the apex, when they are usually associated with degenerative changes in the myocardium. They also occur behind the curtains of the auriculo ventricular valves. They are frequent on the surfaces of the valves, being known in this situation as vegetations.

Thrombi are usually of the mixed red and white type The colourless portions are opaque white, and more or less stringy Thrombi are usually adherent to the heart wall

When thrombi are present in the chambers of the heart infarcts should be looked for in the various organs. If the thrombius is on the right side the infarcts will be found in the lung (except in the rare case of a patent foramen ovale), if on the left side the infarcts may be in brain, spleen, kidney or intestine (see Diagram, p. 66)



Plan of the Circulation to show the Origin and Destination of the more common Embo's.

1. 5. 1 are throub! in Macretia (I.Y.), or its branches, s.g. superficial retus of let

a, b, a no through in time result V h or in broader of v imprifical term of by interest version from Lord S (A), or in its tracks, or critical answer, exh a servable supposite (R-A) and night ventures (R-A), h which sawy give a lay variously supposite (R-A) and night ventures (R-A), h which sawy give the property of commany and interest that the last A is a served to which we have been assumed to the last answer of the A is a served to which we have been assumed to the last answer of the A is a served to the last answer of the last A is a served to the last answer of the l

Post mortem clots, on the other hand, are red or yellow, translucent or transparent, jelly like masses which are not adherent Clots often cling to the columnze carneze, but they are not really adherent to the heart wall

"Agonal' clots occupy a position between the true thromhi and the post mortem clots They are more opaque than the clots, they may be string, but are not adherent They are found more particularly on the right side of the heart, extending up into the pulmonary artery They may completely fill the right auricle and ventricle. They are found especially in pneumonia and other infective conditions

Rounded thromhi lying free in the auricles, so-called " ball " thrombs, are sometimes found in cases of stenosis of the mitral valve. They, as well as other thrombi in the auricles, often show softening, sometimes liquefaction of their interior (red or simple softening)

	Thrombs	Agonal Clots.	Post morten Clots. Anywhere but chiefly on nght side	
Position.	Auncular appendices, valves (vegetations) Apices of ventricles	Mainly right auricle ventricle and pul monary artery		
Appearances.	Opaque white, buff coloured or red	Semi opaque Often fill cavity	Transparent	
Consistence	Stringy, friable some times softened in centre	Soft and	gelatinous	
Relations to heart walls	Adherent. When broken off, leaving portions behind.	Non-adherent May carnez, chordæ ten		
Associated diseased cunditions	Chronic valvular dis- ease of heart Chronic interstitial myocarditis Aneu rysm of heart wall	Infective conditions lobar pneumonia, czemia		

INFLAMMATION OF THE ENDOCARDIUM (ENDOCARDITIS)

The endocardium possesses no direct blood supply, and the heart value very fullet. This fact in all probability accounts for the rarity of inflammatory phenomena in the ordinary sense of the term in connection with these stricture. On the other hand the initiate connection between endocardium and valves and the circultaing blood renders these structures peculiarly susceptible to the action of germs or poisons which may be present in the blood-stream. Once the endocardium is damaged, thormbons tends to occur upon the injured surface, with the formation of what are called vegetations. Another fact in the productions of the more chronic types of endocardiins is strain. Thus the valves of a dilated and powerfully acting heart tend to become thekenot.

Types

- 1 Acute endocarditis
 - (a) Simple or vegetative
 - (b) Ulcerative, maliemant, or infective
- 2 Chronic endocarditis
 - (a) Following acute
 - (b) Associated with atheroma.
 - (c) Associated with strain

I Acute Endecarditis.—That condition is probably in carably due to the presence of germs upon the endocardism. Two sub-varieties are distinguished (a) nimple or regessions, and (b) alterative or medignant. There is no hard-and fast lime between these two. They are both due to the presence of germs, and may be due to the same germs. The simple type, however, has a very constant relationship to acute theumatum, and is thus caused probably by the microcecus returnations. The mulignant type may be caused by a variety of germs, such as pneumococcus, streptococci, stophylasocci, services

In both varieties the essential change is the presence on the damaged valve of vegetations or thrombs and as stated shove no hard and fact line can be drawn between the two conditions. In deciding in any case as to which condition is present the following points should be attended to (1) Character of vegetations These in the ulcerative type tend to be larger and more friable (a) Frient In simple endocarditis the vegetations are limited to a line close to the free margin of the valve. in pleasative endocarditis they extend not merely all over the valve but on to the surface of auricle in the case of mitral disease, on to aorta or heart wall in the case of aortic disease, also in the case of the mitral valve they extend on to the chorde tendines (2) Effect an values. In the case of simple endocardities beyond swelling of the valve no special change is observed In the ulcerative type destruction of the valve, anenrysm or runture of the valve or of the chords tendines is often met with As regards the site, both varieties are found much more commonly on the left side of the heart. When endocarditis occurs dumor feetal life it is found more frequently on the right side

(a) Simple Acute Endocarduts —This is usually met in connection with the mitral and aortic valves, more rarely on triouspid or pulmonary valves. It is most commonly associated with acute rheumatism, but may be found in ease of tonsillius, chorea, scarlet fever, and septicesmis. The valves themselves are somewhat swollen, and on the segments is a firinge consisting of larger or smaller numbers of warty projections (vegetations) (Figs 20 and 21). These vegetations are found not at the free margin but on a line a short distance from that margin. In the case of the mitral valve they are to be found on the upper or annotate surface, in the case of the norther valve on the lower or ventricular. The line on which they occur is that of

maximum pressure of the valves during closure. The vegetations may be soft, frable, and easily removed, or firm and adherent. Infarcts are frequently found in such organs as spleen and kidney.

Microscopic Appearances - The various cellular and fibrous elements in the valve are separated from one another owing to ordema. There may be fibrin present in the connectivetissue spaces, and usually polymorphonuclear leucocytes and young connective tissue cells and other wandering cells are found, in addition to the fixed tissue elements. On the surface of the valve there is a mass of granular material staining with acid dyes, and consisting of blood platelets and fibrin. In addition there may be fibrin threads There are usually numerous white blood eorpuscles which are found in groups Red cells may be present at the free margin, and masses of cerms can be demonstrated by suitable methods in some cases In the later stages evidence of organisation may be found at the junction of valve and thrombus. Spindle shaped and rounded cells may be seen making their way in from the valve to the vegetation. These are fibroblasts resulting from the division of the connective tissue cells of the valve

(b) Ulcerative Infective Endocarditis.-In this type the valve may present the same appearance of slight swelling It is often thickened from previous endocarditis. The vegeta tions tend to be larger and more fnable. They are not limited to the margin of the raise but extend on to auricle or chorde lendinea (Fig 22), ventricle, or sorta There may be destrue tion of the valve substance with ulceration, aneurysmal dilation of a segment, or complete rupture (Fig. 23) Rupture of such structures as chorder tendineer also occurs. Owing to the greater frability there is an increased tendency to embolism and infarction Also the infarcts may be septic In ulcera tive endocarditis the valve often shows fibrous thickening due to previous simple endocarditis. In other words, the acute, as also the subacute ulcerative type, tends to occur in a valve which has already been the seat of endocarditis

Microscopically, the infiltration of the valve with inflam matory cells is more marked. The other appearances are the same, except that masses of micro organisms tend to be larger and more numerous. Actual destruction of the valve substance may be found.

(c) Subacute Endocarditis — This is a term recently introduced to characterise a clinical condition— It is always an ulcerative type of endocarditis lasting many weeks or months

	Simple or Vegetative.	Malignant or Ulterative.		
Character of vegetations	Small, firm	Large, fnable		
Extent	Limited to line close to free margin of valve	Tendency to extend to wall of auricle, and ventricle, to chordæ tendineæ, sorta, etc		
Appearance of valves	Very little alteration, slight swelling	Destruction of valve, accur ysm formation, rupture of valve or chordæ tendineæ Valve often already thick ened from previous acute endocarditis.		
Associated conditions	Chorea, zente rben matism, scarlet fever, infarcts in spicen, etc	Pyzmia, greater tendency to formation of infarcts and embolic abscesses, also acute aneurysms.		
Causal organ 15m	Micrococcus rheumati cus, found in many cases			

in which the valves are already the seat of fibrosis from previous endocarditis The vegetations show the characters and appearances of those in ulcerative endocarditis Embol isro of vessels and infarction are common, and acute aneurysm. often of the superior mesentene artery, is met with due to the blocking of the vessel by an infective embolus and the subsequent weakening of the wall from inflammatory change The causal germ in these cases is usually a streptococcus, often Streptococcus viridans This is a non hæmolytic type of streptococcus which develops green colouration on blood agar medium owing to the production of methemoglobin. It has a relatively low pathogenicity, hence the slow procress of the disease and the chronic character of the lesions produced It can usually be cultivated from the blood in cases of subacute endocarditis, and it is usually present in unmense nurobers in the vegetations and the metastatic lesion It is also found as a pathogenic agent in cases of tonsilistis, otitis media, and dental abscess.

Results of Acute Endocarditis.

- (a) The conditions may return to the normal, the inflam matory exudate and vegetations being absorbed (b) The proliferated connective tissue cells may settle
- down and form new connective tusue, essels at the same time penetrating the valve from the nearest vascular area. The new connective tissue shanks and the valve remains permanently thickened and altered In other words what is called chronic endocardius supervices. This very frequently happens with resulting stensors or moompetence of the valve.
- (c) A second attack is not infrequent when a valve has once been the seat of inflammatory change. As already stated, the ulcerative type tends specially to occur in the case of valves already changed.
- (d) Embolism, infarction, and acute aneurysms in situations such as the mesentene vessels, due to blocking of

branches of the systemic arteries, are very commonly met with, more especially in the case of the ulcerative type of the disease

2 Obvoue Endocarditis —This condition may (i) follow an acute endocarditis owing to organisation and subsequent laying down of new connective tissue, (2) arise slowly owing to the action of chronically acting poisons, such as lead, alcobol, syphilis, retained products of metabolism (gout), or (3) it may be due to strain Chronic thickening of the endocardium lining the cavities of the heart occurs sometimes when the cavities are the seat of chronic dilatation

The valve which is the seat of this change is thickened. The thickening may be chiefly at the line of attachment, may be near the margin, or may occur throughout. The valve is thus opaque and white or yellow in colour. The segments are usually shrunken, misshapen and may be united together so that the onfice is narrowed (Figs 26 and 27). Such thickened valves are often the seat of calcareous deposits which appear as more opaque, yellow masses in the substance of the valve. Sometimes the endocardium over the calcareous deposit necroses from want of nounshment, and so thrombus formation may take place upon the cal careous surface laid bare.

Microscopically such valves may show little beyond an amount of well developed fibrous tissue greater than usual Hyaline degeneration may take place in this connective tissue, also calcareous deposit.

Results of Chronic Endocarditis—The chief results are
(i) Narrocang of the value from adhesion between its
segments, contraction of its fibrous elements, or from both
causes (stenosis) (2) Fasiure of the value to perform its
function of closure of the orifice, due to shinkage and contraction of its segments (incompetence) In consequence of
these two results of the changes as the values themselves are

evtensive series of alterations may take place in the vanous chambers of the heart and in the circulation generally. The diseased condition of the values, with the accompanying changes in the circulation, is generally known as chronic salvalar disease of the heart. According to the valve affected and the type of the lesson, different varieties are distinguished.

EFFECT ON THE HEART AND CIECULATION OF THE DIFFERENT TYPES OF CHRONIC VAL-VULAR DISEASE

z Mitral Stenesus.—This is perhaps the best defined type of chrome valvular disease. It is found chiefly in women, and is due invariably to the adhesion, shrinking, and contraction of the two agements of the mitral valve following acute endocardities of the valve, ever often of rheumatic origin. The valve is thickened, opaque, the segments are united together, and the opening may be a slit and nearly flush with the attachment of the valve (buttonhole mitral) (Fig. 26), or more or less circular and some distance below the level of the attachment of the segments (funnel shaped mitral). The amount of narrowing varies in different curses. Occasionally the contraction is so marked that the valve will not admit the tip of the finger, scarcely a crow out?

The process of narrowing occurs slowly, so that the effect is only gradually felt by the heart. This being the case, the left auried, upon which the strain falls, gradually dilates and its wall thickens in order to overcome the obstruction. For a time the hypertrophical felt sunche may be equal to the task of driving the blood through the narrowed onfice Eventually, however, the tendercy is for the backward pressure to tell upon the pulmonary circulation, so that the lungs show chronic venous congestion. Not infrequently the pulmonary artery exhibits in this condition well marked.

patches of fatty change (atheroma) Through the lungs the pressure tells back upon the right side of the heart, the cavities of which become dilated and their walls thickened (Fig 25). At the same time the backward pressure tells upon the whole venous system, with the result that chronic venous congestion develops in all the organs and viscera, including the heart, as well as in the tissues and limbs. The degree of this congestion depends upon the capacity of the heart to respond to the demands made upon it. When the heart fails to respond, or, as it is usually expressed, when compensation fails, the congestion becomes extreme, and cedema or dropsy tends to appear, more especially in the tissues of the lower limbs.

The left ventricle in mitral stenosis tends to receive less blood than usual Its work is not necessarily interfered with In consequence, it either does not enlarge or it may even become smaller A degree of incompetence of the valve is usually present in mitral stenosis, especially in advanced cases owing to stiffness of the segments. In cases where the incompetence is marked the left ventricle will tend to dilate.

2 Mitral Incompetence —This lesson may occur alone, or it may be combined with a degree of narrowing. It may be associated with thickening and contraction of the valves from a previous acute attack of endocarditis, or, on the other hand, the incompetence of the valve may be merely relative, due to a lax or stretched condition of the band of circular muscles fibres which surround the base of the valve and assist in its closure, or due to dilatation of the ventruel carrying outward the attached papillary muscles. In appear ance the valves are usually thickened, shrunken, and contracted towards their attachment. Not infrequently the chorder tendince are also thickened and shorttened. The lesson is associated with dulatation and hypertrophy of the

left ventrule, then of the left auricle The lungs become congested, and through the lungs the pressure tells back upon the right sideof the heart. Thus the heart in this condition tends to undergo more or less uniform enlargement

3 Aortie Incompeteuce —This condition is due to thickening and shinking of the aggments of the aortic valve. It is often associated with a degree of stenosis. The cause may be (a) a previous acute endocarditis of the aortic valve which is not infrequently associated with endocarditis of the mitral valve, (b) the spread of disease (atheromations or syphilitical) from the aorta, (c) occasionally it may be due to traumatic inpute of a segment which, however, is usually already the seat of chronic changes, (d) very rarely it is caused by congenital malformation or fietal disease. The condition occurs most commonly in men and in later life

In consequence of the failure of the segments to close the onfice during diastole, blood flows backwards again into the left ventricle from the aorta. The cavity has thus to accommodate this blood in addition to what comes normally through the mitral ordice. The left ventrale therefore dilates. At the same time the wall of the cavity hyper trophies in order to drive on the large quantity of blood. This dilatation and hypertrophy of the left ventrale is often very great. The largest hearts on record are from cases of acrtic incompetence The term cor bornum has been applied to them. Subsequently, owing to the great dilatation of the left ventricle, a relative incompetence of the mitral valve may be brought about. Thus there is backward pressure on the left auricle, then on the fungs and the right heart. Owing to the injection of the blood into the aorta by the powerfully acting left ventricle, aneurysmal dilatation of the norta may occur, more especially as the vessel is frequently the seat of disease Owing to the rapid empty ing of the arteries, those going to the field are badly supplied

with blood Hence the marked pallor of individuals suffer ing from this condition, and hence the tendency to fatal syncope

- 4 Aortie Stenosis—This is usually accompanied by more or less incompetence. The cruse may be a previous attack of acute endocarditis, or it may be associated with atheroms of the aorta. The segments of the valve are thickened and often the seat of eakerwords change. They are usually united together, sometimes leaving only a minute aperture for the passage of the blood (Fig. 27). The effect upon the heart is to cause hypertrophy of the left ventricle, which is usually at the same time didated, owing to the exist ence of a certain amount of incompetence.
- 5 Trieuspid incompetence is the commonest valvular lesion on the right side of the heart, and is most commonly merely relative, due to a distact condition of the right ventracle. It is more rarely due to endocarditis, either during extrauterine or fortal life. It leads to dilatation and some hypertrophy of the right auricle, and is associated with marked venous engorgement, and often with pulsation in the vents of the neck and in the liver.
- 6 Trienspid stemosis is a rare condition by itself. It is usually associated with stemosis of the mitral valve. It is due to endocarditis occurring either during feetal or extrauterine life.
- 7 Lesions of the pulmonary valve are very rare, and are usually congenital, being due either to malformation or fortal endocarditis

(EDENA OR DROPSY IN CARDIAC DISEASE

When the heart is failing from degenerative changes in its musculature or from dilatation associated with chronic valvular disease, cedema tends to appear Cardiac cedema is usually distributed about the body in accordance with the

effect of gravity, appearing first and being most marked in the more dependent parts, such as the tissue round the naltes Later on it spreads to other parts and to the serous suspensioneum, pleura, pericardium. As regards the causation of this type of edima, increased pressure within the capillanes from venous congestion is certainly an important factor Experimentally produced wenous obstruction is, however, not necessarily followed by droppy. Another factor must be presupposed. This factor is the damage to the endothelium due to defective nutrition of the cells from analoxy genation of the blood and retention of waste products. At the same time there is also obstruction to the lymphatic return owing to the fact that the larger lymph channels open into vein over-distanced with blood.

PRIMITIVE MUSCULAR TISSUE OF THE HEART AND ITS RELATION TO "HEART BLOCK"

There are two main portions of primitive muscular tusue which should be examined —

- (1) The une-curvalur mode, the site of orgin of the normal stumb for the heart s contraction which is insured between the opening of the superior vena cava and the right auricalizar appendix I its composed of slender muscle fornerve-cells and fibres. It has been found to show subacute and chromic inflammatory change in cases of airshythma.
- (2) The aurocules entracadase handle, which starts from the amendo remnoular mode, sustanted on the inplt sade of the inter-aurocular septum in front of the opening of the corrosary sinns, and above the attachment of the septul cusp of the inter-aurocular septum in front of the interpolar professor in the

membrane, entering the subendocardral tissue of the left ventricle at a point immediately beneath the union of the anterior and right posterior cusps of the nortic valve. It then spreads out in a fan shaped fashion under the endocardium of the left side of the septium, going to the spalliary muscles of the mitral valve and the ventricular muscle. The right branch of the bundle passes down the right side of the septium and is distributed to the papillary muscles and wall of the right ventricle. The bundle is responsible for the conduction of the impulse from auntle to ventricle

In cases of "heart block" the bundle has been found implicated or destroyed in some part of its course. The lesions found have been (1) Acute inflammation from spread of ulcerative endocarditis of mitral or aortic valve, (2) chronic interstitial procarditis and sometimes calcification associated with artenosclerosis of the coronary artery, (3) fibrosis following acute rheumatic inflammation of myocardium, (4) fatty infiltration, (5) tumour formation, eg sarcoma, (6) gumma of heart wall, (7) aneurysm of one of the sinuses of Valsalva involving the septium.

GENERAL METH SETTING ABOUT THE EXAMINATION OF A HE SEEN EXCISED AND OPENED UP

Note in the first instance the size of the organ A rough approximation to the normal size of a heart is obtained by comparing it with the closed fist of the individual. Next note the shape. The normal heart is conical. This shape is retained when the heart is enarged, if that enlargement be due to uniform increase in size of sil the cavities. If, however, the left ventricle be hypertrophy d (as in kidney and arterial disease) out of proportion to the rest, although still conical the organ is elongated. In cases where the right side of the heart is enlarged out of proportion to the left, as in mittal stenoiss and in chronic pulmonary disease, the organ, instead of hemic concal, is ovoid (Fig. 16).

Next examine the visceral pencardium for milk spots, petechal hæmorrhages, fibrinoos exidate, adhesions to the pencardial sac. Then turn to the right side and examine the right auricle as to its size, the fluckness of its walls, its contents (looking more expecially for thromb in the appendix)

Next examine the right ventricle as to its sue, the thickness of the walls, the amount of fat un the subpencardial instead, and whether this fit is actually mading the muscle substance. Estimate the damater of the incuspid valves and examine its eigenstant for thickness and vegetations. The damater may be measured roughly with the fingers. The opening normally admits three dayer. Glance at the polimonary valve for the presence of thicknessing and vegetations.

presence of thickening and vegetations.

Now turn the heart round and examine the left annele as to sue, thickness of walls, thickening of the endocardium, the presence of vegetations or throuts (more especially in the auntle). Examine the left ventucle as to its sue, the thickness of its walls, the appearance of the cut surface of the muscle. Note the colour of the muscle. Look for farty change, more especially in the papillary muscles, for filtered travels, in the examence of chronic interstitial more travels, and the control papillary muscles. Estimate the consistence of the muscle papillary muscles. Estimate the consistence of the muscle by testing its finability.

Now examine the mitral valve as to its diameter. The mening normally admits two degre mitter the backening of the segments and of the segments and of the segments are to the segments and the segment are to the segment and the segment are the segment as the segment are the segment as the seg

Then turn to the aortic valve, estimate its circumference, look for thickening, allefaction, vegetations. Examine the portion of the aortis still attached for atherona. Lastly, look at both coronary arteries, more especially the left, for the presence of dilatation or navrowing, for fatty or calcareous atheroma, and for thromobosis.

HEART WEIGHTS AND MEASUREMENTS

Weight, 9 13 or. (250-370 grammes) Length of left ventricle, 3 31 in. (7 6-8 4 cm.)

Thickness of wall of left ventricle, 1 in. (at thinnest) to 1 in (6-12 cm.).

Length of right ventricle, 31 to 31 in (7 8 8 6 cm.)
Thickness of wall of right ventricle, 1 in. (0 32 cm.)

DIAMETERS AND CIRCUMFERENCES OF THE HEART VALVES (Shennan)

			`	Duameters.	Curcumferences
Tricuspid	٠.		Ins	15 to 18	4 5 to 5 5
			cm	3 8 to 4 7	11 4 to 14 0
Pulmona	ry .		มาร	I1 to 12	34 to 37
			cm	28 to 3 a	86 to 95
Mitral .			ETGS	1 2 to 1 4	37 to 44
			c m	3 0 to 3 5	9 5 to 11 a
Aortic .			ins	00 to 10	28 to 32
			ctn	2 3 to 2 5	7 2 to 8 o

CHAPTER V

DISEASES OF THE LESSELS

THESE may be divided into (') Discases of the Arteries,
(B) Diseases of the Veins

A DISPASES OF THE ARTERIES

In all cases of sudden death the arteries of the internal organs should be slit up and carefully examined for the presence of impacted emboli. More particularly is this the case with the pulmonary and coronary arteries

In cases of senile gangrene the vessels of the affected limb should be opened up and thrombs or impacted embols sought for

Amyloid or Waxy Degeneration.—This is a condition which usually starts in the arteroles, particularly those of the internal organs—spiece, kidney, liver, intestine—and spreads forwards to the capillaires and backwards to the larger vessels. In the case of the medium-rared vessels the change occurs in the middle coat, affecting the bands of connective tissue which he between the tircular muscle filters. The condition is only found on microscopic examination, although by means of rodine, when advanced, it may be midd visible to the naked eye. With rodine the affected area gives a manhogrup brown colour. Amyloid degeneration

should be looked for especially in (1) advanced tuberculosis, (2) visceral syphilis, (3) chronic suppuration, e.g. long-existent empyema, bone disease, etc

Fatty Degeneration of the Intima — This may be seen, more particularly in the aorta, in the form of pale yellow streaks or patches often arranged in the long axis of the vessel. It is associated with anamia and tovernias

Microscopically, the fatty change is found in the endothelial cells and in the subendothelial connective tissue

Galcareous Degeneration of the Media — This is a change found chiefly in old age. It may be preceded by latty or hyaline change, and it affects the medium sized arteries, such as the femoral, brachial, and radial. The arteries which are the seat of the change are hard and brittle and show a transverse stripting very noticeable to the naked eye. Such calcareous change is often found in organs under going atrophy from disuse or senile change. Thus it is frequent in the versels of the uterius in old age and is sometimes also found in the thyroid gland in myxedem. The calcareous deposit is easily recognised under the microscope in specimens stained with hiematoxylin and cosin by the dark purple colour which the morganic material assumes. The condition is usually known as Moncketery's degeneration.

Acute Inflammation—This may occur in the first part of the aorta due to extension of inflammation from acute endocarditis of the ulcerative form. It may occur in artenes passing through areas which are the seat of acute inflammatory change. More frequently it is caused by the impaction of an embolus containing germs, which sets up inflammation in the wall of the vessel and may lead to the formation of an acute aneutysm, eg in a branch of the pulmonary artery, superior mesentenc artery, etc.

ARTERIOSCLEROSIS

Arteriosclerosis, or hardening of the arteries, is an exceedingly common condition, and as defined includes a number of diseases of somewhat different nature and origin. The calcureous degeneration of the media already mentioned is one type. Another type is endarteritis deformans, atheroma, or, as it has more recently been called, atherosclerosis. Another type is sphallituc disease of arterios sclerosis. Another type is sphallituc disease of arterios Lastly, there is hypertrophy of the middle coat of the medium suced and smaller essels.

Types of arteriosclerosis

- r Atheroma, atherosclerosis, endartentis deformans
 - 2 Hypertrophy of the media
- 3 Endartentis obliterans
- 4 Calcareous degeneration of the media (see above)
- 5 Penartentis nodosa.

Atheroma (Gr. abnpn, porndge). Atherosclerosis, Endarteritis Deformans

A nodular and a ciffuse form of the condution are sometimes distinguished, the former affecting the aorta, the coronary, pollmonary, and cerebral arteries, the latter more associated with the medium-sized and smaller vessels, such as the renal and its branches, the radial, and sometimes the coronary and cerebral. The nodular form is, however, not infrequently found in the smaller vessels mentioned.

In the north the condition appears first as streaks or patches of a grey or pearly white appearance, slightly raised above the surface, and due to thickening of the intima. These patches occur especially round the openings where smaller brarches, such as the miterostals, leave the main trunk, also in the arch of the north. Very early in their formation they become opaque and jellow in colour owing to fair.

change The patches gradually increase in size, and eventually become the seat of a calcareous deposit, thus forming hard britle plates in the intima of the vessel (Fig. 28) The intima then tends to degenerate and disappear, leaving a cavity, the floor of which is formed of pulpy necrotic material-the atheromatous ulcer Thrombosis may occur on the diseased area even before the formation of the ulcer. There is an increased tendency to it after the ulcer has developed. When well marked, the change is often found throughout the entire length of the aorta-thoracic and abdominal It tends to be more advanced in the arch and in the lower part of the abdominal aoria just before it bifurcates. Similar changes are to be seen in the larger branches and in the medium sized vessels, such as coronaries, cerebrals, etc. The patchy character of the disease is often particularly well seen in the vessels of the brain (Fig 20), where, owing to their transpar ency, the vellow areas can be seen even in the smaller branches In these medium sized and smaller vessels, such as cerebral and coronary, the thickening of the intima often leads to very marked narrowing of the lumen

A special type of atheroma, termed syphilitie, may be distinguished. It is frequently combined with true atheroma. In position, however it is found especially in the first bart of the aoria, often spreading to and involving the segments of the aortic valve, thus leading to aortic incompetence. Whereas atheroma is a disease of more advanced age, this type is often found in comparatively young people It may not always be syphilitic in origin, but in many cases it undoubtedly is so, spirochætes having been found in the lesions in the vessel wall. This type is char acterised by the formation of large, white, raised, semi trans lucent or opaque white patches There is not the same tendency to fatty and calcareous change, so that the patches remain white and there is no formation of atheromatous ulcers Puckering not infrequently occurs in the centres of these areas Dilatation and ancurvem formation is common

Effects of Atheroma

- (1) Loss of power of the vessel to dilate and contract.
- (a) Narrowing of lumen of vessel, with tendency to degenerative changes in organ or tassue supplied, with replacement of functioning cells by fibrous tissue. In kidney chronic interstitual nephritis, in heart—chronic interstitual mocarditis.
- (3) As a result of narrowing of the lumen there is increased difficulty in driving the blood along, hence hypertrophy of the left ventricle occurs
- (4) Weakening of the vessel wall, with tendency to dilate at some point and form an aneurysm with terdency also to runture
 - (5) Tendency to thrombosis on the diseased areas, with consequent tendency to embolism

Afteroscopically, the earliest change is found to be a proliferation of the subendothelial connective tissue cells. This leads to a thickening of the intima formed of lavers of rounded and spindle shaped connective tissue cells with intercellular fibrils. Owing to the fact that the nourishment of the intima and of the inner portion of the media is obtained from the blood circulating within the vessel stself, the deeper portions of the thickened intima underro fatty, and eventually calcareous, change Fatty globules and crystals of fatty acids are found in the degenerated area, also granules of calcium salts. Changes are also to be observed in the internal elastic lamina splits into fine fibrils and becomes fragmented. This damage to the internal elastic lumina is regarded generally as the primary change. The media may also show fatty degeneration, owing to interference with its nourishmen. It not infrequently gives way, and the vessel becomes dilated.

In the case of the aorta the changes in the media may be more marked. There may be invasion of vessels from the vasa vasorum into the media, and around these vessels there are numerous round cells.

In the syphilitic type, in addition to the greatly thickened intima composed of layers of well formed fibrous tissue without

fatty or calcareous change, there is marked change in the media. This takes the form of an invasion of the media by vessels accompanied by connective tissue. This results in a replacement of the media by filorious scar tissue, the contraction of which causes the puckenings

Causation .- During the first twenty years of life there is a progressive thickening of the coats of the vessels with a progressive development of clastic tissue. For the next twenty years of life approximately things remain stationary. After that there is a progressive detenoration in the elastic , tissue, with consequent weakening of the vessel wall certain individuals the elastic tissue of the vessels is congenitally deficient. Atheroma is a disease which develops at the time of his when the vessels are beginning to deteriorate, but the individual is at the height of his physical activities. High blood pressure from bodily exertion, combined with degenerat ing elastic tissue, are the two main factors in the disease. Sometimes the one sometimes the other is the more prominent. That bigh pressure of itse'f can produce the condition is proved by the experimental work on animals administration of doses of adrenalin over periods of weeks and months, thus causing contraction of the vessels and raising the blood pressure, it has been found possible to produce changes in the vessels of rabbits analogous to atheroma in the human subject. The same thing has been effected by holding the animal up by the hind legs for a few minutes every day for some weeks. In this way well marked degenerative changes very similar to human atheroma have been produced in the vessels above the diaphragm

Infective conditions such as syphilis, typhoid fever, etc., and by causing profilerative changes of an inflammatory nature in the intima. As a result there is maintimon of the vessel wall subjacent to the thickened area with consequent degenerative changes

In the human subject toxic conditions associated with high blood pressure, such as renal disease, lead poisoning, gout, alcoholic poisoning, are also factors in the production of the disease. At the same time, infective conditions such as synthis cannot be invoiced.

As to the nature of the numary change, this is generally, regarded as being a fragmentation and fibrillation of the

internal clastic largina. Subsequent to the s, and with a view to repairing the damage, there is a prol feration of the cell of the intima, with resultant thickening. Owing to the fact that the intima and outer port on of the media obta in the roomshment from the bood flowing in the vessel itself, the deeper portion of this new tissue, and the adjacent media undergo degeneration of a fairly nature. The fatty acids which are formed are believed to combine with alkelate to form soaps. Among these soaps are calcium combinations. The fatty acid is rejected by the calcium in favour of carbonate and phosphate in a resultat form, activational and bosophate in a restulate form.

Summary of Causes of Atherems

- (1) Old age
 (2) Congenital deficiency in clastic tissue of vessels.
- (1) Strain.
- (4) Chronic toxem as-alcohol, gout.
- (s) Infective condit ons-syphilis, typhoid, etc.

Hypertrophy of the Media.

This is another form of arteno-sclerous due to contraction under prolonged sumulation by the influence of touc substances circulating within the vessel. It is very characteristically associated with the subscute and chronic forms of Binght's disease. The condution affects the medium-sized and smaller vessels. The hypertrophy of the musicular coat is followed by a fibrous transformation.

Endarteritis Obliterans or Proliferans

This is type of arterial disease associated with thickening of the intima in which there is no tendency to degenerative change, as in atheronia. The reason is that the new tissue laid down within the internal elastic lamina carries with it its own blood vessels. This tissue, is, unother words, granulation tissue. The condition is found associated with all types of chronic inflammation, e.g. tuberculosis, syphilis, leptony, It is usually regarded as being specially sign ficant of the

presence of syphilute disease, but it is just as frequent in tuberculosis. It is found in the vessels in the neighbourhood of syphilute guinnata and in vessels in the lung, bones and joints in tuberculosis. Sometimes it occurs in the vessels of the brain m syphilis, thomboss in these vessels in early life being a not infrequent cause of cerebral paralysis. In the long in tuberculosis the change is a most beneficial one, as the tendency to rupture of vessels in the neighbourhood of cavities is thereby greatly diminished. It is probable that the atrophy of limbs in tuberculous joint and bone affections may in part be explained by malnutrition following diministion in size of lumen of the nourishing vessels. As might be anticipated, the change is often accompanied by inflammation of the other coats of the vessel, more especially the adventities.

Microstopically, the condition is characterised by the faying door of layers of new tissue within the internal elastic lamma. At first the tissue is celloids, later on it becomes well developed connective tissue. Very often new layers of elastic tissue are formed, and sometimes there are several small vessels within the compass of the original vessel wall. In addition, there are inflammatory changes in media and adventitia, more especially the latter

Arterial Disease in Syphilis — Syphilis affects the arteries in several ways. It is one of the infective conditions leading to afferoma, more especially to that type called syphilitio, where the aorta is the seat of formation of raised, white, senii translucent areas with a tendency to puckering

Another type of lesson found more especially in the smaller arteries is the above mentioned endarteritis obliterans, with accompanying perarteritis

Syphilistic disease of vessels is a frequent cause of aneurysm formation and of thrombosis

Arterial Disease in Tuberculosis —Tuberculous disease has a marked tendency to spread by the perivascular lymph atics," and thus has from the commencement an intimate association with vessels. This condition of periartents leads to a thickneing of the vessel. The process may spread inwards and produce an endartents. Sometimes a tuber culous focus may burst its way through a vessel wall, thus group ms to a central blood infection.

This endarteritis is found in a marked degree in all cases of chronic pulmonary tuberculosis. It is also found in the smaller vessels in the neighbourhood of tuberculous lesions of bones and joints. As in syphilis the thickened intima shows no tendency to degeneration in its deeper norts.

The inflammatory change in the vessel walls in the neighbourhood of cavities may lead to weakening, aneuryim formation, or rupture. As previously stated, it more free onently causes more or less complete obliteration.

Anenryam

An anearysm is a localised enlargement of the lumen of an artery The enlargement may involve the whole lumen for a short distance (Justform aneurym), or it may be a discriticulum from one side of the sessel (saccular aneurym) (Fig. 31)

The term acute answaysm is applied to any rapid dilatation of an artery through an inflammatory process in its wal', usually due to the presence of a septic thrombus withan its lumen. A false answaysm is an accumulation of blood commamicating with a vestel and surrounded, not by the vestel wall, but by a condensation of thesse in the neighbour hood. A distancing answaysm is a condition, found justally in the aorta, where the blood finds its way, commonly by a split in a calcareous athromatous patch between the intuma and media, or between media and adventitis, or again between two layers of media. Sometimes the blood finds its way back again at a different level into the human.

aneurysm is applied to minute dilatations, usually of a saccular type, occurring on the course of the smaller cerebral arteries

The most common site for aneutysm is the thorace aorta the ascending portion, the arch or descending portion. The next most common site is the abdominal aorta, then come the popliteal and carotid arteries. The special type, military aneury sm, is found in the cerebral vessels. Aneutysms also occur in the branches of the pulmonary artery in the neigh bourhood of tuberculous cavities (Fig. 52), and as the result of septic embolism.

Ancurysms vary greatly in size and shape. The cavity may be largely filled with white and red thrombus, often with a laminated appearance. This thrombus is seldon the seat of organisation. The wall may be formed of all present at all, is in patches. This, no doubt, is the explanation of the non-occurrence of organisation in the thrombus contents. The media may also disappear and the wall be formed only of adventitia and condensed connective tissue surrounding. Occasionally the wall is partly formed of bony structures such as the vertebriz (Fig. 31). The wall of the vessel in the neighbourhood is usually the seat of atheromatous chance, frequently of the symbolitic type.

Changes produced in Surrounding Parts. These depend upon the position of the aneurysm. The dilating vessel presses upon viscera, such as trachea, bronchi osophagus, upon nerves and vessels. Thus mitation or paralysis of nerves—recurrent laryngeal, trunks of the brachial plexus—results. Pressure on trachea and bronch leads to accumula tion of secretion, and sometimes to gangrene of the lung, also to erosion and rupture. Pressure on ecophagus similarly causes obstruction, and may result in rupture. Bones such as sternium and vertebrae are croded, also cartilage but the softer the tissue the better it resists, so that intervertebral

discs may project beyond the harder bone. Pressure upon lung leads to collapse and atrophy

Smaller vessels arrang from the aneurysmal portion of the vessel tend to be contorted, and sometimes their fumen obstructed by thrombus The heart may be displaced downwards, and may be hypertrophied

Rupture may occur through the skn in thorace ancuryam projecting forwards into the tracked, bronch, esophagus, pericardial sac, pulmonary artery In the case of cerebral ancuryans, into the brun substance or under the membranes, in phthisical ancuryans, into the lung cavity, with consequent harmoptysis

Causation —Two factors are concerned in the causation

(1) Conditions which lead to weakening of the vessel wall, (a) injury as from a gunshot wound, (b) disease, such as (b) acute attentia from inflammation around the vessel or from impaction of a septic embodies in the vessel, (ii) chromic attentias from atheroma, more especially the syphilitic type

(a) Conditions leading to sudden rise of blood pressure,

The condition is far more frequent in males than in females (out of 189 cases, 171 males). It occurs as a rule above forty years of age, 1c at the penod when the vessels are beginning to degenerate while the individual is still in active work. In something over 50 per cent of cases a history of apphills may be abtained.

Periarteritis Modosa.—This is a very rare disease, only some go cases having been described up to date in medical hierature. It is usually met an males and is more frequent in the adult. It is seldom diagnosed during life, the case being amply one of progressive weakness and wasting with fever, although hard bead like swellings may sometimes be recognized in the skin of the thorist and abdomen due to nodular threlemings on the subcustaneous arteries. Post mortem, these nodes, which are usually the size of a pea of under, are found along the course of the vessels of the internal

organs such as heart, liver, ledneys, spleen, mesentery, pancreas, and sometimes brain Infarctions in heart, spleen, liver, and kidneys are very commonly met with The only instance of necrotic infarct of the liver which the author has seen was a case of this kind.

The process appears to begin as an inflammatory change in the adventitia, associated with round cell infiltration and proliferation of the endothelium of the vasa visorum. The change spreads to the media and is followed by hyalme and necrotic change in the non-striped muscle, which then gives way along with the elastic laminz, leading to the formation of multiple small aneurysms. Thrombosis often follows with organisation of the thromby, thus producing the infarctions

Opinion is divided as to the cause of the disease. Some ascribe it to the action of a vinis of inknown nature. Others consider that the condition is a syphilitic one. Certainly in a considerable percentage of cases a history of syphilis bas been obtained. There are others again who separate the syphilitic cases into a special category by themselves.

B DISEASES OF VEINS

Thrombona occurs in veins where the blood current is slowed from dilatation and vancosity. In all probability in addition there must be some inflammatory condition of the vessel wall leading to damage of the endothelium. The condition may be found in any ten where walls are inflamed. Thus the small venous radicles in the neighbourhood of any inflammatory focus tend to undergo thrombosis. When organisms invade such thrombo and soften and break them down, portions of the thrombos containing germs are apt to be carried away by the blood current and deposited in distant organs. The liver is affected when the rootlets of the portal vein are thrombosed, the lung, in the case of other venous radicles, becomes the seat of septuc embolism and abscess formation (see daarram, p. 66)

Thrombous once started tends to spread Not infrequently the change begins in the pouch of a valve. The thrombus grows until it blocks the lumen of the vessel. Then the blood current being stopped, thrombous occurs in the vessel up to the next Juge branch. Subsequently another slow thrombous process starts, until again the vessel is blocked. In this way the process initiated in a small rootle of the femoral vein may pass up as far as the inferior vena cava.

Thrombi in vens may become organised and may lead to obhteration of the vessel Or they may be the seat of deposit of calcareous material forming so-called phileboliths. Again, sometimes the thrombus in ourse of organisation may be tunnelled and the circulation re-established

Two types of thrombs are distinguished according to their colour, (a) red, (b) white. Red thrombs form when the blood is suddenly brought to a standstill, white thrombs are formed when the blood is in motion.

Thrombi in veins not infrequently undergo softening. Two types of softening are distinguished. (a) simple softening. (b) septic, due to the action of germs.

Alteroscopically, thrombi consist of the blood elements (red corpuscles, white cells, and blood platelets) in varying proportion, bound together by filaments of fibrin.

- (a) In the case of red thrombs the predominant element is the red blood corpuscle. There are a few white cells, and between the cell elements filamentous and granular fibran. Sometimes the red cells stain well, at other times they have lost their characteristic staming reaction and only their outlines are visible.
- (b) In white thrombi leacocytes, platelets, and fibrin pre dominate. Organisation is frequently seen. The first stage in the process is a envering over of the thrombia with a layer of spindle shaped endothehal cells from a proideration of those liming the vessel. Then from the subendothehal and other connective tissue layers, young connective tissue cells emigrate.

neto the thrombus created as a rounded mononuclear cells to begun with, later on they become spindle shaped. At the same time the endothelial cells of the vasa vasorium proliferate, forming buds of vessels which penetrate the thrombus Both these processes occur at points where the thrombus is in contact with the vessel wall. Elsewhere the endothelium covering the thrombus develops buds which penetrate the substance of the coagulum and become filled with blood from the original lumine. Subsequently these various blood channels unite with one another, become enlarged, and thus the thrombus becomes tunnelled. During the process of organisa tion, pignent (hemistodiu) granules are deposited in large numbers in the cells.

Dilatation and Varicosity—This is a condition which is found more especially in the superficial veins of the lower limbs, in the veins of the scrotum (varicocele), rectum (harmorrhoids), and esophagus

As regards causation there is undoubtedly a tendency to the condition in certain individuals owing to a congenital weakness in the elastic tissue of the vessel wall. The condition is aggravated by gravity. It may also be caused by obstruction to the return of the blood by the wearing of tight garters, by the presence of a tumour or hard fecal masses pressing on the iliac vens, or by a currhotic liver interfering with the flow of blood through the portal vens, and affecting more especially the rootlets from the rectum and ecosphagus.

The vens which are the seat of the change are dilated and there may be thrombosis within them Ulceration from skin, essophagus, or rectum may lead to erosion and consequent himmorphage.

Phiebrius, or inflammation of the wall of a vein, may be due to injury, or to an inflammatory focus in the neighbour hood of a vein, as in appendicitis, osteomyelitis, erysipelas It may also occur in syphilis and in gout. The condition is always associated with more or less thrembosis or clotting of the blood within the vessel It is one of the most important pathological conditions especially when it is due to the action of germs Veins, on account of their thin walls, are much more liable to inflammation than arteries, and on account of the slow current in the blood throrobosis occurs more readily

Further, because of the increasing size of the lumen in the direction of the blood current, portions of clot are more readily washed away. As previously stated, these thrombus fragments become strained off, in the case of the systemic veins in the lungs in the case of the portal veins in the liver If the fragments contain germs, secondary foci of infection, often abscesses, are set up Very minute fragments and individual bacteria when shed off may pass the capillary barner and enter the arternal circulation, when a general septicemia or pyemia results. Sometimes the thrombosis is the primary process and the germs invade later, as in puerperal septicemia. At other times (sinus thrombosis in middle ear disease, osteomyelitis, appendicitis) the inflam

matory condition sets up the thrombosis in the veins of the surrounding tissue Results -Obliteration of the vein, washing away of portions of thrombs, and so formation of embols, metastatic focs of infection in organs such as lung and liver, reabsorption, or

tunnelling

CHAPTER VI

DISEASES OF THE BLOOD, BONE MARROW, LYMPH GLANDS, SPLEEN, AND DUCTLESS GLANDS

DISEASES OF THE BLOOD

ALTHOUGH it is unquestionably better to examine the blood during the life of the patient, it is still possible to do so after death. The ease with which this can be done depends to a great extent upon how far the blood has coagulated within vessels and heart There is, however, in blood diseases, such as anæmias and leukæmias, a tendency for the blood to remain fluid so that films may often be readily obtained either from heart blood or vessels

(For the bacteriological examination of the blood, see p. 442.)

Septicamia and Pyamia. - Micro-organisms enter the blood in many injective conditions. In fact, in most acute infective diseases the causal organism can be cultivated from the blood at some period. Even in the more chronic forms, such as tuberculosis, germs can be detected in the blood in a considerable proportion of cases Such con ditions, in which living organisms are circulating in the blood stream, are usually known as septicemias Formerly the term was somewhat restricted in its use, now it may be applied to a large number of acute infective processes 97

including typhoid fever and pneumonia. In the human subject the germs are almost never present in numbers sufficient for their demonstration readily in standed blood films. Concentration or cultural methods have to be adopted before their presence can be detected. On the other hand, the same germs may, when introduced into one of the lower animals, give rue to a condition in which immense numbers of film organisms can be demonstrated microscopically in the blood. This is notably the case with the pneumococcus and the anthrax facilities.

The organisms may enter the blood, in the case of the smaller blood vessels, through an intact vessel. In other instances an abscess or similar infereive focus (in tiberculous a caseous focus) may rupture directly into the blood-attram, it may be into a vessel of considerable size, usually a ven. In a majority of mitances, in the more acute infective diseases, the actual invasion of the vessel is preceded by a thrombosis within the lumen, the thrombosis than the lumen of the today, there to set up metastatic inflammatory focu, or abscesses. This condition of invasion of the blood-stream by organisms plus the format time of metastatic abscesses is usually known as pyerums.

The primary focus from which the infection of the blood organists varies very moch. It may be the infection as in typhoid feer, the organism probably reaching the blood by way of the lymphatics. It may be the lung as in accite lobur pneumonal, the organisms passing directly from the alteol into the pulmonary capillaries. In the conditions more usually characterised by the terms septicamia, it is commonly a supportative focus in the threat, appendix, bone (in osteromyelita), prostate, or an endocarditis of the malignant or ulterative type.

When secondary suppurative foci develop these may be found in kidneys, liver, brain, or indeed in any part of the body in the case of an ulcerative endocardits, in the lungs most commonly in the case of an esteomyelits, in the liver in the case of the appendix (portal pyaemic type of liver abscess)

Sometimes a condition may start by being merely a septicemia Subsequently it develops into an ulcerative endocarditis and pyzmia. Apparently organisms in the blood stream have a special tendency to become deposited on the heart valves, especially such as have already been damaged.

Both in miliary tuberculosis and in septicamia the secondary infective foci invade blood vessels in their neigh bourhood and so further infect the blood stream with germs

Anamia

Anama or bloodlessness may be defined as definency in one or more of the blood elements. Commonly the index to the degree of anamna is taken as the number of red cells and the percentage of harmoglobin. In some cases the one, in others the other, shows the greater dimmution. This decrease in the red elements may or may not be accompanied by deficiency of leucocytes, which is known separately as leucopenia. The amount of plasma varies in different kinds of anamina, being excessive in the chlorotic type and varying in amount in the perincious variety.

Anamia may be due to various causes These may be classified as follows

- T. Defective ingestion of blood forming ingredients, as in cases of star-ation and obstruction to the entrance of food, eg in stricture of the ecsophagus Deficiency of such chemical substances as iron Defective gastric secretion or achylia
- 2 Any chronic drain upon the system which it is unable to supply, as for example the persistent loss of albumen through

the kidneys in Bright's disease and repeated hæmorrhages from the uterus, bowel, or other passage.

- 3 Interference with the formation and renewal of the blood.
 This is probably the commonest cause of all. It may be due to many and various factors. The more important of these are
- (a) Infections and intovactions, such as in fevers, prolonged suppurations, chronic infective disease, eg tuberculosis and syphilis Poisons such as lead act in a similar way Such conditions operate chiefly through their influence on the bone marrow.
- (6) Failure of the red cell forming marrow through replacement of it by some other tissue. This may be, although rarely, due to the presence of metastases of malignant timours in the bone or bone marrow. Such are sometimes found in cases of caracinams of the prostate and breast. In a case recently under the writer's notice the vertebre and the long bones were the seat of numerous large deposits of malignant growth replacing the proper tissue and leading to a profound anamia. The primary timour in this case was in the prostate. A similar result may be produced by a thickening of the bone at the expense of the marrow cavity. Probably for this reason the not very appropriate term of optical calls of animals has been given to this group of cases.

ostroiteratic anamia has been given to this group of cases
Again, the red cell forming tissue may be crowded out on
account of excessive activity in the white cell producing
marrow. This we find in the different types of leukermia.

Again, the marrow may be replaced by a low-grade type of tissue of no use in forming red cells. Such is the case sometimes in old age and prolonged toxermax, e.g. syphilis, when myxomatous or fibrous tissue replaces the marrow Or again, farty issue may be found not only in the shafts where it is normal, but at the ends of the bones where it is normal. The term a platfar enarmar has been given to this type of case, which is due to a complete failure of the erythroblastic tissue to react

4 Lastly, we have increased less or destructions of the blood as a cause of annerma. The blood is always undergoing destruction, but in normal cases this is balanced by regeneration. Sometimes the destruction is in excess of the regeneration and then annerms superviewes. It is in most cases very difficult to state with certainty how far this process is operative and how far an annerms is due to interference with regeneration, but in what is called permitteous annerma the evidence of blood destruction by organs such as the liver, spleen, and bone marrow is so great that it is difficult to believe that it is not a prime factor in the bloodlessness, at the same time in such cases toxic substances acting on the marrow are probably often the mutal cause.

Ágam, the destruction may be due to the direct action of a parasite on the blood cells, as in malaria. Or it may be due to the influence of some (harmolytic) poison on the blood corpuscles, this poison being sometimes a chemical substance such as potassium chlorate, sometimes an animal poison such as those obtained from snakes and spiders. Similar harmolytic poisons are produced by bacteria (B tetant) and by plants (Rinnus communical).

Then again the anzima may be due to actual loss of blood (a) from deficient coagulation following injuries as in hzero-phila, or (b) from escape from the vessels either in large quantities at one time or repeatedly in smaller quantities. This loss may be due to some injury or disease such as cancer creding large vessels or tuberculous disease destroying lung tissue, or it may be due to an exaggeration of a normal loss as from the uterus at the menstrual period.

Anemias are often classified into (a) Primary and (b) Scoolary, the primary anemia being due to no definite recognisable cause, the secondary anemia being due to such a cause. The distinction is obviously not a good one, as the primary anemias are also due to some although as yet unrecognised cause. Thus we distinguish as primary

anæmias chlorosis and permicious anæmia and as secondary the anæmia of Bught's disease and cancer, esteosclerotic anæmia, and aplastic anæmia.

The post mortem appearances in the anæmias, with the exception of the permicious variety, are neither constant nor characteristic. Pallor of the skin, mucous membrane, and internal organs is the one and only feature always present. In the severer types small hiemorrhages are found in serous and mucous membrane Fatty change in liver and other parenchymatous organs, also in the endothelium of vessels. tends to occur because of the lack of oxygen in the tissues in any prolonged anzema. The bone marrow, except in the aplastic type, tends to show an ervihroblastic reaction extending from the ends into the shafts of the long bone marrow Excessive pigmentations of liver, spleen, etc., is only found in the permicious type. The various causes of a secondary anamia should always be looked for carefully The possibility of secondary deposits in such bones as the vertebræ should be examined in all malignant cases, more especially in those of the prostate, breast, and thyroid. Any elaborate investigation of the long bones is a difficult matter, but slices are readily removed from the anterior surface of the bodies of the vertebrz by means of a flexible saw

Chlorous is not a condition which is often fatal. There are no constant or characteristic appearances found after death beyond pallor and fatty change with erythroblatic reaction of bone marrow. Thrombous may occur spontaneously especially in such vessels as the brain, and Virchow described a condition of hypoplasia of the beart and sorta

Pernicious Anamia.—In performing a post mortem examination in a case of this disease the following changes will be found with a remarkable degree of constancy

The skin is pale, often with a lemon yellow tint due to a slight degree of jaundice. The subcutaneous fat may be

considerable in amount and shows a bright yellow colour. In communing the serous sacs muntle hemorthages will be found, more especially under the visceral pleura and pencardium. The lungs are pale and show atrophic emphysema. Not infrequently small hemorthages are found in the substance of the lungs as well as under the pleura, and on microscopic examination fatty change may be found in the endothelial cells of the vessels. The hard may be dilated, and is very constantly the seat of a fatty degeneration of the muscular substance, which is best seen on the inner aspect of the left ventricle, more especially on the papillary muscle. The change is of the patchy type described as "thrush breast heart." The blood within the heart cavities is often fluid and always pale.

The titer is pale and of a yellow brown colour. It shows fatty degeneration and a marked increase of iron-containing pigment (hemosuderin). This can be demonstrated by pouring over the organ ferrocyanide of potassium (e per cent), and hydrochloric acid (if per cent), repeating the process several times if the characteristic. Prissian blue, colour does not at once appear. The pigment is present mainly round the outer part of each lobule (see frontispiece)

Microscopic Appearances —The granules are found within the liver cells mainly in the outer two-thirds of the lobule, and also in the endothelial cells of the vessels. Necrotic areas are sometimes present in the lobules. In the vessels nucleated red cells and endothelial cells containing red corpuscles as well as pigment granules are to be found. Fatty degeneration is present in the central part of the lobule.

Another charge of interest found inscriscopically in organs such as liver, spleen, and furph glands is the presence of small foct of marrow consisting of nucleated red cells and myelocytes. In the liver these are found in the sinusoid, in the spleen in the pulp spaces, and in the lymph glands in the stinuse.

The spleen is of a dark brownish red colour Hæmosiderin

may be present in sufficient amount to be demonstrated macroscopically. In any case it will be found microscopically within the endothelial cells of the pulp sinuses, which also show marked phagocytosis for red blood corpuscles.

The kidney may show nephritis of a catarrhal or interstitual type. It is very pale in colour and often exhibits the same Prussian blue reaction as is found in liver and spleen.

The mucous membrane of the stomach and intestine is pale, petechial hamorrhages are often present, and there is atrophy of the mucous membrane

The bone marrow in the shafts of the long bones, which is normally of a yellow colour and is composed of fat, is transformed into a bright red marrow with a gelatinous appearance and consistence. There tends to be an absorption of the bone to make room for the marrow.

Meroscopically, there is a marked erythroblastic reaction, the deals showing evidence of active proliferation. Many of them are of the large sucheared type known as megatolastic. There is also evidence of playeeyus activity on the part of the par

Occasionally in the spinal cord degenerative changes, with consequent sclerosis, are found in the posterior and posterolateral columns

The chief blood charger of permicous anoma may be briefly recapitulated. There is marked dimunition in the number of red blood corpuseles (average count ij millions), with a less marked dimunition in basingsibous (average 40 per cent), so that the colour index (the ratio of the percentage of hemoglobus to the percentage number of corpuseles, e.g. as above, "31s per great ritha musty". On the examination of a film of blood the main change is found to be variation in sure of the blood corpusels (macroexyte is and increes test being

present), with marked variation in shape (polkilocytosis) Nucleated red corpusales are usually to be found, and of these the large variety (inegaloblast) predominates over the normoblast. In addition, basophil granules are often found scattered through the corpusales (punctate basophila or granular degeneration), and not infrequently the red cell takes on both acid and basic dye, assuming thus a blush colour (poly-ciromatophila). The leavelytes are commonly reduced in number, with a slight relative increase of the lymphocytes. The blood lates are also fewer in number.

In secondary anæmas the appearances found post mortem are, of course, many and vanous, depending upon the nature of the primary cause

Hæmochromatosis — Although not associated with a severe degree of anæmia, this is a condition in which, as in permicious anæmia, hemochem is deposited in international organs such as liver and pancreas in very large quantities. This deposition is accompanied by cirrhosis, resulting, when the pancreas is affected, in so-called bronard diabetes. For long the cause of the condition was unknown, but the recent work of Mallory appears to prove that the disease is a chronic form of copper poisoning.

Splente Anemia — Thus term is commonly used to characterise cases of severe, unexplained aniemia, in which splenue enlargement is a prominent feature. Undoubtedly a number of different conditions have been included. An adult and an infantite type are described.

Under the adult form the condition known as Bants a discusse may be classified. This is characterized by an en largement of the spltein with curbons of the liver and atheroma of the splein and portal vessels. Microscopically, the splein shows a diffuse fibrosis both of the Malpighian bodies and of the reticulum. The Gaucher type of spleine enlargement also comes under the beading. In it the spleen is enormously enlarged and the paraenchyma is transformed

into spaces resembling the alread of a gland. These spaces are lined by peculiar, large monounclear cells. The liver is also enlarged and contains groups of these cells. Similar cells are also present in the bone marrow.

The infantile type of splenic anamia has no constant features. The enlarged spleni shows microscopically a general fibrosis.

The blood pictures in splenic anxima are not constant or characteristic. The general type is that of a secondary anxima with a relatively excessive diminution in the per centage of bixmoglobin, hence a low colour index. As a rule the leucocytes are diminished

Leukemia (Lencocythemia)

Two main types of this condition are recognised -

- (1) Myelocythemia, myelamia, spleno-medullary leukamia.
- (2) Lymphocythemia, lymphamia, lymphatic leukamia

(i) Myelocythemia.—This is a condition in which there is an enormous proliferation of leucocyte and leucocyte forming cells, mainly of the granular variety, chiefly in the bone marrow. The result is that fully developed leucocytes and immature forms (myelocytes) overflow into the circulation in large numbers. The disease is probably a tumour formation related to the assroomata.

The blood is often paler than normal Large greenshyellow or white dots may be found in the beart and vessels. Flims show an enormous preponderance of white bloodcorpuseles. Instead of the normal proportion of r white to 500 reds, there may be 1 to 10, or even 1 to 1. The presailing types of feurocyte present are the polymorphonuclear and the neutrophil myelocyte. These latter are very large cells, not infrequently so p. im diameter, with large, pale nucles and neutrophil granules in their protoplasm. In addition, there is a marked increase in the number of cosmophils, and cosnophil myelocytes are also present in large numbers. Mast cells (cells with basophil granules) are present, often in great numbers. There are considerable numbers of lymphocytes and other hyaline cells, but these are relatively greatly diminished. The red cells are reduced in number and nucleated red cells of the normobiast type are usually present.

The organs generally tend to be enlarged and have a pale appearance

The spleen is usually greatly enlarged (Fig. 33). It may weigh as much as 18 lbs. The enlargement is uniform, and the shape with the notches is preserved. The organ may reach as far down as the pubs. In consistence the organ is firm. The surface often shows chronic perisplenitis. Infarcts are very commonly present. On section, the cut surface has a uniformly pale pink, flesh like appearance. The Malpighian bodies are invisible.

Microscopic Appearance:—The sinuses of the pulp are file with leucocytes of the different types. In addition, there are numerous swollen endothelial cells, in some of which red blood corpuscles can be seen. There is increase of fibrous tissue and pigment, the fibrous tissue spreading from around trabecules and vessels. Malpighnan books are inconspictions

The bone marrow throughout the body has a pale pink colour. The marrow of the shafts of the long bones, instead of being fatty, has a similar pale pink appearance

Microtropically, granular cells of all kinds are found present in greatly increased numbers. There is evidence of great rapidity of division (mitotic figures) among all types of myelocytes. Red cells are relatively few in number.

The liver (p 241) and kidneys (p 289) are enlarged and pale, and show microscopically more or less infiltration with leucocytic cells The lymphatic glands may or may not be enlarged

(2) Lymphocythemia. In this type of the disease there

is a proliferation of the leucocytes of the non-granular or hyaline type These overflow into the blood and infiltrate the organs The condition, like the previous, is probably neonlastic in nature

The blood is pale, and films show usually a marked increase of white corpuscles. This is seldom so marked as in the previous type of the disease. Occasionally there is no increase. The prevailing type of leucocyte is the lymphocyte, large or small. These form from 90 per cent to 99 per cent of the white corpuscles. Granular cells are few and far between. The red blood cells are reduced in numbers, and nucleated corpuscles are usually present.

The appearance of the bone marrow is similar to that found in myelocythemia. But on microscopic examination lymphocytes instead of the granular cells predominate

The lymphatic glands are very commonly enlarged, sometimes attaining the size of a hen s egg

Alicroscopically, they are found infiltrated with immense numbers of lymphocytes.

The spices is usually enlarged, although it does not attain the size of the organ in well marked cases of myelocythemia.

Liver and kidneys tend also to be enlarged, the latter are usually very pale and show numerous hamorrhages scattered through them

Chloroma.—This is a rare condition, found chiefly in male infants. It is characterised by the presence of greensh coloured tumours, mainly in connection with the periotetium of bones, e_E in the orbit, causing marked protrusion of the cyballs and on the vertebur. These, on microscopie examination, show the character of round-cell surromats. Deposits with similar characters may be found in the lymphatic glands and bone marrow, and in the liver and kidneys. The colors upon the masses is due to a pigment which occurs in a granulty form, and is probably of a fatty rature of the first of the course of the colors of the color Blood films show appearances similar to those seen in lymphocythæmia. A myeloid type also occurs

Polyeythamia, or increase in the number of red corpuscles per unit volume of blood, is due to various causes. It is not an infrequent occurrence brought about through loss of fluid from the plasma and consequent concentration of blood as in diarrheas, or through some demand for increase in the number of oxygen earners, as, for example, in persons living at a high altitude. Another type of the condition is met with in chronic lung and heart disease when there is backward pressure and cyanosis. In such cases the merease is probably local, due to concentration of the red cells in the peripheral capillaries.

There is, however, a disease in which a marked and per sistent increase in the number of blood cells and in the amount of circulating blood is found. This is known as polycythamia rubra or splenomegalic polycythæmia. The blood is dark coloured The number of red cells may reach 14,000,000 The hæmoglobin is also increased, but not so greatly as the red cells. There is a slight increase in the leucocytes. The volume of blood is raised and may be two and a hall times the normal The heart is hypertrophied and the vessels thickened Spontaneous severe hæmorrhages tend to occur from the stomach or other mucous membrane, but give only temporary relief The spleen is enlarged, and the red marrow extends from the ends into the shafts of the long bone. The exact cause of the condition is unknown, but it would seem that there is an uncontrolled increased production of red corpuscles on the part of the marrow due to hypertrophy

CLASSIFICATION OF DISEASES AND REACTION OF THE BLOOD
AND BLOOD-FORMING ORGANS

A. Reactions and Hyperplasias of Hyaline Cells
(a) With leakage into the circulating blood

r With overgrowth of lymphoid tissue and lymphoid infiltration of organs

Chronic and Acute Lymphatic Leukamia

2 With tumours of an invading type Lymthoid Chloroma

3 Lymphocytosis often with focal infiltration in infections such as tuberculosis, syphilis, and whooping-cough, and in cachevias such as permicious ana mia,

4 Large hyaline cell leucocytosis as in malaria

(b) Without leakage into the circulating blood s With turnours involving bone marrow

Lymphoid Willoma

6 With regional invading tumour like growth . Lymphosarcoma 7 With general lymphoid hyperplasia and sub-

acute infections Status Lymphaticus

B Reactions and Hyperplasias of Granular Cells,

(a) With leakage into the circulating blood 8 With infiltration of the organs

> Myeloid Leukamia o With invading tumours of the myeloid tissue Myeloid Chloroma

10 Polymorphonuclear leucocytosis, often with focal infiltration of tissue as in a majority of acute infections.

11 Eosmophil lescocytosis as in many animal parasitie diseases etc., sometimes with focal infiltration of tissue as in asthma.

(b) Without leakage into the blood 12 With tumours of myeloid tissue Mycloid Mycloma

- C. Tumour like swelling of Lymph Glands with nodules in Spleen associated with a gradual replacement of lymphadenoid tissue by overgrowth of stroma and endothelial elements, probably infective
 - 13 Hodgkin's disease or Lymphadenoma
 - D Reactions and Hyperplasias of Red Cells
 - (a) With leakage into the circulating blood
 - 14 Polycytbæmia
 - (b) Without leakage into the blood 15 Red cell myeloma

HÆMORRHAGIC DISEASES

Hæmorrhage, or escape of blood from the vessels or heart, is a feature of a great many diseases. It is due either to a damage of the vessel or beart wall from disease or injury, or to unusual blood pressure within Not infrequently both factors are operative. Sometimes it is due not so much to these factors as to deficient coagulability of the blood That is to say, some slight imperceptible injury starts the hæmor rhage and nature fails to close the breach. Hæmorrhages may be localised and solitary or widespread and numerous. when very minute the term petechial hamorrhage is applied Most of the localised or focal hamorrhages are dealt with under the heading of the various organs-lung, brain, etc. Conditions in which hamorrhage is a feature-where it occurs as a widespread manifestation-may be classified together as Hæmorrhagic diseases. The morbid anatomist meets with these widespread hamorrhages frequently They are to be sought for in particular situations, notably skin; serous membranes such as pleura, perstoneum, perscardium. mucous membranes such as intestine, bladder, and, less frequently, in solid organs such as spleen and brain. The conditions in which they are found may be classified as follows 1 Infective diseases such as pyarma and ulcerative endocarditis, and specific infections such as cerebro spinal mening its and epidemic encephalitis. In such cases the factor which weakens the vessel wall is the toxin of the bacteria, sometimes it is an infective embolius blocking a vessel.

- 2 Toxic conditions such as jaundice (where the damage to the vessel wall is due to the action of the reabsorbed bile salts), snake bites, quinine poisoning
- 3 Cachectic conditions such as scurvy and the severe anzemias, notably permicious anzemia. The factor bere is deficient nourishment of the vascular endothelium, which gives way in consequence
- 4 Cases where there is a sudden rise in blood pressure, such as death from suffocation

Purpura is a term which is seldom used by pathologists. In its clinical significance it covers cases where visible hamor thage into the tissues is a main feature. The following types may be distinguished.

- 1 Purpura hamorrhagica a fault of the blood in which the blood platelets are greatly diminished. In fatal cases hemorrhages are found into vanous organs of the body, especially into the central nervous system.
- 2. Symphometic furpura, a disease in which there is usually a normal number of blood platelets. The pathology of the condition is not clear, but it is supposed that some change in the small blood vessels causing increased periocability is the explanation of the hamorrhages. It is possible that an anaphylactic element is present in such cases. It may be that in some infection e.g. by streptocorc plays a part. The incidence of the hamorrhage is variable. To those cases which are combined with color, in which diffuse hamorrhage into the bowel is found, the texts Henneks purpura has been given. Such cases are often accompanied by nephritis. Rheumatic or enfants purpura has been used to designate those associated with mobility atthicts.

Scurry is a disease caused by improper diet-an excess

of meat (especially salted meat), and an absence of fresh vegetables. The particular element wanting in this diet is C vitamine. It is characterised by a swollen, spongy con dition of the guins which readily bleed, and by hæmorrhages under the skin and into the muscles and joints. The disease is believed to be an acid intoxication with diminished alkali mity of the blood. The coagulation of the blood is slow and micromplete, the other characters being those of a secondary anemia. Post mortem, beyond the appearances of cacheva and the hæmorrhages into the skin and muscles, there is little to note.

Infantile Scurry (Barlows disease) is a condition which is occasionally seen in unfants, not infrequently those of the well to-do. It is also due to an absence of C vitamines from feeding with boiled or pasteurised milk or proprietary foods such as dried milks. Marked cases are characterised by fusiform swellings of the shafts of the long bones, particularly the tibia and femur. These swellings are due to hamorrhage beneath the periosteum. The periosteum is always highly vascular. Occasionally the condution is seen also in the upper extremities. Fracture of the shafts of the long bones is occasionally met with Microscopically, the bones are abnormally vascular and there is absorption of the bony trabecular. There is also defective bone formation, and the marroy may be replaced by mycomatous tissue.

Hamophills is a hereditary disease occurring almost exclusively in the males but transmitted exclusively by the females of a family. It is characterised by a tendency to persistent bleeding either spontaneous, or from slight wounds, such as the socket of a tooth. Although sometimes fatal, nothing abnormal is to be found post mortern. It is stated that there is an unusual thinness of the blood vessels with fatty change in the intima. This, however, is not alway-present, and may be merely the result of secondary anemia Without doubt the uncontrolled bleedings are to be ascribed

to defective coagulability in the blood, in all probability to a deficiency in the amount of prothrombin. Sometimes the large points, especially the knee, show in this condition appearances not unlike those found in rheumatoid arthritis. There is thickening and fibrillation of the symovial membrane with the formation of fringes which are colouted yellow red from old harmorrhages. At the same time there is also destruction of the arrivaliar cardiages.

DISEASES OF THE RONE MARROW

At birth the bones of the body, both long and flat, are filled with active, blood producing marrow, and contain no fat. Certain bones, notably the stremun, innominate bones, vertebre, and nots, retain this character throughout life, but in the case of the long bones a gradual process of irmaiormat ton of the red marrow into fat occurs. This process begins to be visible about the age of puberry. Commencing in the shaft it gradually extends towards the ends of the bones Islands of active marrow remain even in the shafts, especially in relation to the bone itself, but the main reservoirs of harmopoienc tissue in the long bones are to be found in the ends From all these reservoirs, should a demand for increased netwirty arise, the blood forming tissue is able to extend, and it may be again to occupy the marrow cavity of the shaft.

At the autopsy the bone marrow should be examined in such readily accessible positions as the ribb. Ip resenting the marrow out by means of bone foreeps. Films of the ribb row can then be made and, after fixation (best in corrower sublimate), standed by such methods as Wights, Leshman, 5, or Jenner's. An examination of this kind will give information as to the cell process taking place in the marrow generally, but in order to obtain some notion of the extent of the active marrow area, i.e. whether or no regenerative and hypertrophic changes have occurred, the marrow of the shaft of one of the long bones should be investigated. Of course more

complete information is obtained by examining the whole length of the bone in section, but this is seldom permissible, and the pathologist has to be content with an examination of a small segment of a shaft of, e_S , the femur. This examination may readily be carried out by making a small incision on the outer aspect of the thigh, inserting a narrow saw and removing two or three inches of bone. In this situation the marrow may be scooped out in mass by means of a needle or sharp narrow knife, fixed like any other organ or tissue, and cut in parafilin or cellolum. Films may at the same time be made should it be considered necessary.

Another situation in which an investigation of marrow is readily carried out is the bodies of the vertebræ. Slices of bone can be removed from the spinal column, especially in the projecting lumbar region, by the use of a flat saw with the back removed.

The marrow should be examined more especially in all cases of anizmia, in cases where there is enlargement of spleen or lymph glands, in infective conditions such as pneumonia or endocarditis, and in cases of malignant tumour, particularly of breast, porstate, and thyrod cland

The functions of the marrow are (a) the formation of red blood corpuscles, (b) the formation of all types of white blood cells and of blood platelets, (c) the destruction of effete red cells, (d) the formation of an internal lining to the bone by which new bone can be produced or removed, and (c) the storage of fait. The two main functions are of course the formation of red and whate corpuscles, and the chief pathological changes are found in relation to diseases of the blood involving these cell elements. The centres for forming the two types of corpuscles are mixed up with one another so that when any numsual demand is made upon one or other function the increased activity on the part of one type of tissue results in interference with the function of the other type. But the marrow possesses in remarkable degree the capacity to

hypertrophy in response to an increased demand for its cell elements, red or white. This hypertrophy tabes place from the active cell forming marrow at the expense of the fatty marrow situated chiefly in the shafts of the long bones. When all available space is occupied by active marrow the area can be still further increased by absorption of bone. This sometimes takes place in severe cases of permicious animum. Moreover, under similar circumstances metastatic deposits of active marrow may be found in organ such as liver, spleen, and fymph glands. In fact there is probably no organ of the body so capable of rapid and extensive response to a stimulus.

Inasmuch as there are, roughly speaking, two types of cells produced by the matrow, so two types of regenerative hypertrophy are to be distinguished (1) or jointhians matrice, in which the response is mainly on the part of the red cell forming tusive, and (2) leacoblastic matrice, in which the response is their from the fewcorts-forming cells.

Erythroblastic Marrow is found in cases where there has been a cill upon the red cell forming function, such as anarmas of all kinds both primary and secondary with the exception of aplastic anarma. It is also found in the disease polycythemia rubar. The marrow is redder than aorimal and extends from the ends into the shafts of the long bones, replacing the fatty marrow. In extreme cases, as in pernicuous anarmas, the appearance has been compared with that of red current pelly. In this disease the bony trabecule may be absorbed to a certain extent, feaving the interior of the shaft smooth. It is in this disease also that metastatic deposits of red marrow sometimes occur in organs such as spleen, liver, and lymph gland. These deposits are, however, only visible on microscopic extinuation.

Microscopically, this type of marrow is characterised by a relative increase in the number of red cells chiefly of the nucleated variety, many of these showing evidence of active

division More especially in permicious anietina the nucleated red corpuscles are of a specially large type (negaloblast). Another function of the marrow is often strikingly in evidence in permicious anietina, and that is the blood-destroying function. Thus phagocytosis of endothelial cells for red corpuscles and hemationism and himmosiderin pigmentation is often very marked

Lencohlastic Marrow is found in all infective conditions associated with the presence of excess of leucocytes in the creational pholod, e.g. pneumonia, infective endocarditis. It is also found in the two types of leukemia. Two varieties of the condition are distinguished according to the type of ell chiefly involved in the reaction, whether granular cell (impleogita) or small hyaline cell (impleogita). In virtue of the greater dilution of the red cell elements such a marrow has a paler appearance than the normal. The more marked the reaction the greater is the replacement of fatty marrow by this pale red marrow. In the leukemias the replacement is often complete, extending throughout the shaft, the marrow has a mottled appearance due to paler patches alternating with red crythroblastic tissay.

Attensequently, such marrow shows increased proliferative activity on the part of the white cell forming issue. Myelocytes of all kinds are to be found in process of multiplication. In infective conditions and in myelocytherma the granular cells, both fine and course, predominate. In conditions such as status lymphaticus, nekets and lymphocytherma the lymphocyte predominate. In both types the red cell forming function is relatively quiescent, so that nucleated and fully formed red corpuscles are few, and as a result there is a relative dimunition of the red elements in the circulating blood.

Aplasia—Although in a majority of instances the bone marrow responds to the formative stimulus, in some cases it fails to do so not does so only imperfectly. This failure, complete or incomplete, may be due to a congenital defect, to some toxin inhibiting its activities, or to some tissue, fibrous or neoplastic, occupying the interior of the bones. The result in all cases is the same—a failure adequately to

replace the blood cells which are constantly being destroyed in the wear and tear of life, with consequent animia. Such an animia is known as aplastic (see p. 100)

Degenerations.—In old age and under the influence of chromocally acting toxins the active marrow tissue is apt to be replaced by fibrous or rivyxomatous tissue. The poison of sphilips is peculiarly apt to act in this way with resulting severe anzema. Areas of focal necross occur in the bone marrow in cases of typhoid fever just as they do in such organs as spleen and liver.

Inflammations.—Organisms of all Linds have a special tendency to lodge in bone marrow. This is no doubt due to the vascularity of the tissue. As these inflammations early affect the bony tissue, they are properly considered under the heading of ottomyclitis (see p. 3*3).

Tumours.—Tumours occurring in the interior of bones may be primary or secondary. The primary ones form a group to which the term my down is given. They are all of the nature of sarcomas and beat a relation to the blood diseases known collectively at the leukemass. They must be distinguished firm the myelod or grant cell sarcoma (see p. 5%).

Such tumours are commonly multiple and occur in many bones at the same time. They appear as grey or pink areas in the marrow, absorbing the bone and thus leading to spontaneous fracture. Metastases in tissues other than bone piarrow are rare. A peculiar form of albumose (Bence-Jones) appears in the unine in some easies of multiple mydomi.

Microscopically, four forms of that myeloma are distinguished. One, which arises from the primitive nucleated red cell and is composed of small round cells, is extremely rare and is known as erythrocytoria. Another type is composed of lymphocytes and another of plastus cells. Still another in which the cells are large and may be granular arises from the myelocytes and is known as implectytoria. Else table, p. 109, 1

Secondary growths in marrow are usually carcinomas in

which the primary tumours are found in prostate, breast, or thyroid. They lead to the formation of more or less fibrous tissue which with the tumour tissue replaces the marrow proper, leading to a form of secondary animal (osteosclerotic) Such secondary deposits commonly arrive by way of the blood stream as the marrow possesses no lymphatics, but direct invasion of the vertebris by continuity of tissues from infiltrated retro-pentioneal glands probably occurs

DISEASES OF LYMPH GLANDS

Atrophy of the lymphadenoid tissue occurs in old age. The fibrous stroroa of the nodes increases at the expense of the lymphatic tissue. Thus the glands become smaller, firmer, and, unless pigmented, paler in appearance

Amyloid degeneration of the arterioles of the lymph follicles and of the reticulum is soroctimes found in the conditions in which waxy disease tends to occur. It is found occasionally apart from the generalised disease as local amyloid. Such glands are pale, sorocwhat translucent, enlarged, and firm

Hyaline degeneration of the reticulum of lymph glands is a common occurrence in tuberculosis and other infect ive diseases. The connective-tissue fibres become swollen, homogeneous, and stain uniformly with acid dyes such as easin or fuchion.

Galetteation of lymph glands is a common occurrence in old, healed tuberculosis, the calcareous material being deposited in the necrotic caseous foot. Sometimes comparatively large aggregations of mineral salts are found, the size of a pea. When jugged these may work their way through into a channel such as a bronchus, causing, it may be, severe hemorrhage in so doing

Pigmentation.—The pigment found in lymph glands may be derived from internal sources such as extravasated blood, or from external sources such as carbon, stone, and the colour mg matter used in tattooing Carbon pigmentation more or less pronounced is practically a constant finding in bronchal and mediastinal glands.

The particles of pigment become deposited first in the smuses. They set up irritation associated with proliferation of endothchal and connective issue cells. Such glands are charged, firm, sometimes hard and gritty, grey, black, yellow, or partic-cloured, according to the pigment present. The microscopic appearances are those met with in chronic lymphademits.

Edema of lymph glands is common in cases of passive congestion, drops), and minimation of an acute type. Such glands are inlarged, pale, or pink according to the amount of congestion, translucent and moderately firm, but exuding fluid on pressure. Microscopically, the sinuses are distended, and the vanous tissue elements more or less world yearnated

from one another

Acute Lymphadenitis—This is to be seen in the glands through which drain the lymphaties of any area that happens to be the seat of acute inflammatory changes, the avillary or inguinal glands in cases of poisoned wounds and bubonic plague, the mesentence glands in typhod lever. The gland is enlarged, often congested, fairly firm in consistence, sometimes with areas of hemorrhage or necrosis, or even softening and supportation.

Alteresceptually, the blood vessels are congested, there is infitration with infilamation equalities, which is sometimes fibrinous, proliferation and throung-off of the endobleall cells Laing the sinuses areas of harmorizing and necrosis, with possibly accumulations of polymorphonousless recovery, and in some cases (playue, typho d) the causal organism in considerable number.

Chronic Lymphadenitis.—This is to be observed in connection with areas will ere there is chronic inflammation of any kind, also as the result of the presence of pigment. The

gland is enlarged and firm, the capsule thickened and often adherent to neighbouring glands. On section, the structure is pale unless pigment is present

Microscopically, there is fibrous overgrowth in the capsule and trabeculæ. There is also entarth and proliferation of the endothelial cells of the sinuses and proliferation of the lymphoid cells.

Tuberenious Lymphademitis — This is a very common condition, and should be carefully looked for in all cases. The glands which are the seat of the change are enlarged in the early stage they are discrete, and, on section, grey and translucent, with, as a rule, areas of opaque white or yellow cascation. In the later stages they tend to be adherent to one another and to surrounding structures, their capsules are thickened, and, on section, the gland substance shows cascous (Fig. 37) and sometimes also calcareous change Eurdence of tuberculosis should be looked for more especially in the cervical, mediastinal, branchial, mesentene, and retropentioneal groups of glands.

Microscopically, as addition to the changes found in a on specific chronic inflammation (see above), there are typical tubercle follicles and areas of caseation. Tubercle bacilli are commonly few and scattered. When they occur they are usually to be found in a zone at the margin of the caseous area. Occa sonally they may be found in considerable numbers, and sometimes in the guant and epithelioid cells. Hyaline and very occasionally amyloid change may be found in the stroma and wills of vessels.

Byphilitle Lymphadenitls—In the primary stage of the disease the lymph nodes draming the area of infection show the appearance of an acute inflammation, sometimes with suppurative softening

In the secondary stage many different groups of lymph glands, cervical, epitrochlear, axillary, inguinal, tend to be enlarged and firm

Microscopic sections show proliferation of endothelial cells

in the surface and fibrous thickening of capsule and trabeculæ
The glands may remain in this condition for a long period,
or they may undergo resolution

In the tertuary stage lymph glands may become the seat of chronic inflammatory processes and occasionally of gummata, which show the usual features of a caseous centre surrounded by a fibrous capsule.

Lymphadenoma or Hodgkin's Disease (also known as Pseudoleukæmia)—This is a condition which, on the one hand, resembles madignant growths, and, on the other hand, the chronic inflammatory conditions, such as tuberculous Certain cases, with all the characteristic appearances of lymphadenoma, have been proved to be tuberculous by inoculating animals with portions of glands. Other cases resemble very closely the anoperance in lymphadenombasaroma.

The changes in the glands consist of an enlargement, urually greater than that found in therculosis, of a group or of several groups, such as the cervical, axillary, mediastinal, abdominal, inguinal The cervical group is the one most frequently first affected (Fig. 58). The glands while enlarging tend to remain discrete (cf. tuberculosis). They vary in size from a pea up to a hen's egg. They are usually firm. On section, they are grey and somewhat translucent with obvious bands of shungs connective tissue, and possibly with yellow areas of necrosis. These areas of necrosis differ from the case-ous areas found in tuberculosis to being small and less opposite.

Microscopically, in the carliest stage there is a hyperplana of the lymphocyc cell element, later there is a multiplication of the endothelial elements at the expense of the lymphod cells, which may be relatively few and fir betaen. Many of these endothelial cells have more than one nucleus, but when there are several nucleu these are in a group, not perpherally arranged as in the typical gant cell of tuberculous. The tissue not infrequently aboves unfittation with essemphil elements of the property and the computer of the nucleus shall be a supported by the control of connective tissue fibers, both in connection with the cassivel and

in the substance of the gland. The fibrous transformation is found most marked in the more advanced cases. Areas of necrosis may be present. Hyaline swelling of the connective tissue fibres may be present. Observers such as Fraenkel and Mucb claim to have demonstrated a granular form of the tubercle hacillus. More recently a duphtheroid organism has been isolated by Negr. Bunting and Yates by injecting this organism into monkeys have produced lesions similar to those found in Hodgkins disease. But similar bacilli have been found in other widely different diseases. There can be little doubt that the disease is due to some organism, but it is fairly generally admitted that the germ has yet to be discovered.

Similar changes are to be found in certain of the internal organs, more particularly the spleen (see p 129), less frequently the liver (p 241) and lunes

Hypertrophy -- Under this heading may be considered the somewhat indefinite condition known as Status Lymphaticus Found chiefly in young children, the disease, if such it may be called, is characterised by a general pallor of the skin from anamia, while at the same time the child is well nourished, often fat. In older people the sexual organs show imperfect development, and the suprarenals are small The lymphoid tissue of the body generally is increased—the tonsils, lymph glands, spleen, and lymphatic tissue of the intestine are all enlarged. The thymus gland either does not show its customary atrophy after the age of twenty, or it may actually be increased in size. In some cases no more than this lymphoid hyperplasia is found after death many instances this is complicated by an infection such as a broncho pneumonia But there would appear to be no doubt that those with this diathesis easily and often suddenly succumb to conditions not usually fatal in more robust individuals Some regard the condition as one of subacute infection, others see in it a congenital fault affecting the lymphoid tissue A certain proportion of the fatal cases in children are due to cerebral harmorrhage apparently connected

with imperfect development of the walls of the blood vessels of the brain.

Tumours of the Lymph Glands — Lymphomata or tumours of lymphatic tissue, in which the various elements retain their normal proportions, may be found in the mediastinum, tonsils, etc.

Lymphosarcomata or malagnant growths arising in connection with, and having the structure of lymphatic tissue, are found not infrequently in the mediantium invading the roots of the lungs, or in the abdomen. They tend to produce metastates in the other organs. They form a very malagnant type of tumour, and usually show microscopically the appear aree of a round-cell screens.

Secondary growths in glands are to be looked for in all cases of malizmant disease, more especially in carcinoma

DISEASES OF THE SPLEEN

Buyture of the spleen is common in severe injuries of the abdomen. The bleeding from the torn organ is usually severe, and may be fatal. A spleen enlarged from disease, as in malana, is ant to rupture from a comparatively shots injury.

Atrophy—Thu is practically a normal process in extreme older and the organ becomes smaller, its capsule thickened and shrivelled. On section, there is found an increase of fibrous tissue, the pulp is of a dull, reddish brown colour and bloodless. The organ is somewhat tough in consistence

Waxy or Amyloid Degeneration—This change is to be looked for in all cases of prolonged suppuration, advanced tuberculosis, and visceral syphilis There are two types of the condition

(c) Sage—The organ is usually somewhat increased in size, but the increase may not be marked. In consistence it is usually firm, and, when cut into, the edges remain sharp. The cut surface shows numbers of round, translucent areas, uniform in sure, but varying in size in different eases, and regular in distribution (Fig 34) These give the typical mahogany brown reaction with iodine solution

Microscopically, the waxy change is found to be chiefly in the Malpighian bodies. The central artery may or may not be affected. Round the artery there is often an area comparatively free from the change. The elements affected are (1) the connective tissue of the capillaries, which run from the central artery to open into the pulp, and (2) the reticulum of the lymphoid tissue. The lymphocytes themselves are pressed upon and disappear. In addition (3) the intermiscular connective tissue of the middle coat of the arterioles running through the pulp will probably show the change

(a) Duffute — In this variety the organ is always distinctly enlarged. It is firm, shows a sharp margin on cutting, and its cut surface has a translucent appearance and is of a pinksh red colour. With iodine a diffuse mahogany brown reaction is given. This types the one most usually found in syphilitic cases.

Alterstochically, the change may be found, as in the previous variety, in the Malughan bodies, but often it is restricted to the walls (periendothelial connective tissue) of the venous sinuses. Frequently the sinuses are particularly well seen, owing to the organ being the seat of chromic venous congestion. The arterioles of the pulp, and sometimes those of the Majuphan bodies, may show the change.

Hyaline Degeneration of the artenoles of the spleen is found in certain infective fevers, such as diphtheria and scarlatina. The condition gives use of itself to no obvious alteration

Microscopically, the change is found chiefly in the intima of the artenoles, which show a homogeneous swelling, partially obliterating the lumen of the vessels.

Pigmentation.—The spleen is specially hable to post mortem pigmentation owing to its position close to the stomach and large bowel. The organ shows a greenish black colour, which penetrates for a variable distance into its substance. It is due to the action of the sulphuretted hydrogen escaping from the hollow viscera and acting upon the free iron in the organ, producing black sulphide of iron. In severe anamus, in malata, and in toxic conditions, there is increase of iron containing pigment in the organ. This, more particularly in the case of anamus, may be in such quantity as to be demonstrable to the naked eye. The Prussian blue reaction with datte hydrochloric acid and potassium ferrocyanide is usually not well seen in the case of the spleen, owing to the large quantity of blood in the pulp

CIRCULATORY DISTURBANCES

Hæmorrhage —In addition to large hæmorrhages the result of injury small petechial hæmorrhages are found. These are a common accompaniment of the torus spleen of pneumona and other infective diseases.

Acute Congestion or Active Hypersemia.—This is containly seen in acute tour conductors, such as pretuments, septicemia, acute fevers, etc. The spleen is enlarged, soft as a rule (although in typhoid fever it is often fairly firm), and pale in colour. On section, the pulp is found to be very soft, often capable of being washed away in a stream of water. The colour is a creamy pink The Malpigham bodies are sometimes prominent, more expecially in children There are not infrequently himmorrhages.

Mirrostopically, the snuses are found to be distended with blood, which shows a larger proportion of 8 white cells than usual. There is swelling of the endothelial cells liming the snuses, and these can often be seen to contain red blood corposicles. In 17 photo fever, areas of focal necrosis are always found, and of ea distinct masses of bacilli. In other conditions, organisms may be demonstrable, and even the commencement of abscess formation may be found. True abscess formation in the spleens is zare

Chronic Venous Congestion or Passive Hyperæmia.— This condition is found in (1) chronic valvular disease of the heart, (2) chronic pulmonary disease, (3) cirrhosis of the liver The spleen is uniformly enlarged, retaining its normal shape and notches. There may be opaque areas of chronic persplentix. Not infrequently depressed yellow areas (pale infarcts) or dimples or puckerings indicating absorbed infarcts are visible on the surface (Fig. 3a). The remainder of the organ is of a dark purple colour. In consistence it is firm. The cut surface is dark purple, with white specks and lines indicating trabecules, which may be more prominent than usual. Malendam bodies are not easily serious.

Microscopically, there may be some increase of the periendo thehal connective tissue in the walls of the sinuses. The sinuses themselves are distended with blood. Their endothehal cells are swollen and show mindisad phagocytosis of red blood corpuscies. Pigment derivac our these latter may be seen in the cells. Under the microscope it is exceedingly difficult to distinguish chronic from actic concretion.

Infarction.—This may be due to ("bolism, (2) thrombosis occurring in a diseased artery o , /ein

The infarcted areas may be red or pale, and in the early stages are raised above the surface (fig. 37) Later on they become depressed, and eventually form a pucker on the surface and cicatrix in the substance. The larger infarcts may extend right across the surface of the organ. On section, the smaller ones are, as a rule, wedge-shape, and situated superficially. The blocked vessel may be visible at the apex of the wedge, the base being formed by the surface of the organ. In the case of the older infarcts a zone of fibrous tissue forms round the margin. Within this there is frequently a zone of yellow (harmatodin) pigment Rarely the infarcted areas may undergo softening. This softening may be simile or spatic.

Microscopic Appearances — In the earliest stage (red infarct) all that is to be noted is overfilling of the sinuses with blood and the presence of fibrin filaments hetween the blood cells. Later (pale infarct) the nuclei of the splenic cells are found to have lost their characteristic staning reaction. The outline of the innuess and individual cells may still be seen. Still later, all evidence of structure disappears. Round the inflatted area there develops a rone of granulation issue, comsuring of young blood vessels, leucocytes, and fibroblasts in various stages of development. Within this sone, bunches of yellow accular crystals of hamatoidin are frequently to be observed.

INFLAMMATIONS

Acute Perisplenitis is seen in all cases of acute general peritonitis

Chronic Perisplenitis is very frequently seen as pearly white areas of theketing in the eapeule of the organ. The thickening may be disableable and very hard, even like cartillages. It is frequent in cases where the organ is enlarged, as in leukamy. Adhesions to the parieties are not infrequently as disable and a cases of inherculous peritoints the capsule of the organ often shows characteristic tuberde granu's stons.

Acute Inflatamation of the Spicen Substance.—
Micro-organisms carculating in the blood stream are very apt to be strained off in their passage through the spicen. Hence in canditions such as pneumonia and typhoid small calonies of the causal germ are frequently to be found in the spicen pulp. These may or may not be associated with small food of necrosis. On the other hand, anything in the nature of large centres of acute inflammation are rare. This is no doubt due to the large amount of blood which the organ contains, germs not multiplying readily in blood itself. The appearances in such spicens have already been discussed under acute congestion. Occasionally in septic infarction an approximation to supportant softening may occur.

Chronic Interstitial Splenitis.—This condition, associated with enlargement and increase in consistence owing to

fibross, is met with in a variety of diseases, such as chrome cenous congestion, lymphadenoma, kukemia, and malana The increase in the fibrous tissue varies greatly in extent and position. It is always found in the trabeculæ and capsule as well as round the vessels. In lymphadenoma it is found chiefly in the Malpiphian bodies, in lenkamia mainly in the pulp. In all there is a tendency to pigmentation in connection with the growing fibrous tissue. The lymphoid elements tend to disappear while the endothelial cells increase in number.

Tuberrulosus of the spleen is invariably associated with tubercle elsewhere. Two types of the condition occur (i) The commonest form is military tuberculosis associated with generalised infection. The organ is usually not much altered in size. Scattered through it are mumerous minute grey, white, or yellow points, which are often difficult to distunciate from Maloughan bodies.

Microscopically, there are found tubercle folicies with giant cells and surrounding epithelioid cells, or centres of commen eing caseation

(a) The other form of tuberculoss in the spleen shows large, rounded, opaque white or yellow caseous masses scattered through the organ, the o-called 'hard bake" spleen, from the resemblance to almond toffee (Fig 33) This variety is found cheldy in children

Lymphadenoms or Hodgkin a Disease (also known as Pseudoleukisma) — Thus is a disease primarily of the lymphatic glands (p rzz). The spleen is, however, very constantly affected, especially in advanced cases. When affected the organ is almost invariably enlarged. The enlargement is uniform, although there may be projections on the surface. On section, numerous opaque, pale bodies, angular in shape and more or less uniformly distributed

(Fig. 35), are to be seen. Sometimes they are grouped into masses (Fig. 36). At first grey and somewhat translucent, they become more opaque white in the later stages, and stand out in marked contrast to the general colour of the spleen, which is punk to dark red. The whole appearance of the cut surface is compared to masses of suct in a pudding.

Microscopically, the appearances are essentially those seen in the lymphatic glands. The change is primarily in the Malpighan bodies, which in the early stage show merely hyperplana of the lymphocyte cell elements. Soon the large spindle-shaped endothelial cells appear, many of which are multi nucleated, while the lymphocytes diminish in numbers. The large endothelial cells itsend to pass into the pulp, and as they are actively phagocytic they take up red cells, and later show himmatodin pigment. Fibrosis commoneces at a comparatively early stage, and later the Malp ghun body may become entirely transformed into a knot of well developed fibrous trissue. Not infrequently areas of necrosis occur, as in the lymphatic glands.

For changes in the spleen in the various blood diseases see under leukæmia, etc

Tumours of the spleen are rare

Angiomata and angiosarcomata, the latter with secondary deposits in the liver, are described Secondary tumours are also rate, sarcomata being occasion-

ally found

EXAMINATION OF THE SPLEEN REMOVED FROM THE BODY

Note in the first instance the size of the spleen. The normal organ measures about 5 medes by 3 (12 5 x 7 5 m.), and the weight is 5.5 or (150-350 gm.). If the spleen is enlarged, note whether this enlargement is uniform, the organ retaining its normal shape, or localised. The spleen is uniformly enlarged in acute congestions, chronic venous congestion, amploid disease, lymphadenoma, leukuma, malana, etc. It is irregularly calarged in some cases of lymphaderoma, in

tumour and cyst formations. It is dimmished in size in the attention of old are and in wasting diseases.

Examine the surface for the tenings of the capsule, perioneal tubercles, evidence of infarction, etc. Determine the consistence. The normal organ is moderately firm. In acute congestion it is soft, in chronic venous congestion, waxy disease, lymphadenoma, and leukamin the consistence is increased. After making a longitudinal incision into the organ, note whether the edge of the cut becomes rounded, as is the case when the consistence is norteased. Examine the cut surface for the relative prominence of the Majngham bodies (these are usually much more obvious in children than in adults), for hamorrhages, materix 6, opacities, etc. Note the general colour of the organ, which normally is brownish purple.

DISEASES OF THE THYROID GLAND

There is no organ of the body in which size and weight vary so greatly as in the case of the thyroid gland. This is due to the widespread prevalence of an enlargement usually termed goitre or bronchocele. This enlargement occurs both in a sporndict and an endeme manner. It is difficult therefore to give a normal weight for the organ at any age. It is stated that the normal adult gland should not weigh more than 25 30 gm (about one ounce). The gland is larger in females than in makes, and it undergoes an increase in size during mentituation and presenacy.

Accessory thyroid ussue sometimes occurs, usually in close contact with the main gland, occasionally behind the stemum, where a gottrous enlargement may lead to pressure effects. These accessory glands must not be confused with the para thyroids, which are distinct organs with a function of their own.

Aplasia or congenital absence of the gland results in congenital myxeedema characterised by dwarfism and idiocy. Instead of the two fobes of the gland are found nodules with mucus-containing cystic spaces

Atrophy of the gland in infancy gives rise to the sporadic form of cretinism, and in adult life to myxordema. Endemic cretinism is associated with a goitrous enlargement of the gland It occurs in the regions in which goitre is common. especially in the valleys of the Alps and Himalayas The Cretin is a dwarf in whom the growth of the skeleton is speci ally arrested The skin is dry and the hair tends to fall out. The subcutaneous tissue is swollen, leading to pallor and puffi ness of the face. The nose is depressed. The abdomen is prominent, and pads of fat are present over the clavicles There is usually arrest in the development of the brain with resultant idiocy, but eases occur in which the mentality is not greatly affected As stated above, the sporadic form of the disease is associated with congenital absence or early atmohy of the thyroid The pathology therefore is the same as in myxædema, se the disease is due to hypothyroidism, and cases rapidly improve under thyroid treatment. The nathology of the endemic form is not so clear. There is usually a goitrous ancestry to be traced, and the condition is closely related to that disease, occurring as it does in the costrous areas

Myzadema z a syndrame which comes on as a result of removal by operation or destruction by disease of the thyroid gland. The individual suffering from it presents a very characteristic picture. The meantality is slugged. The face has a bloated appearance, the colour is pale pellow, while there is a malar flush. The laps are thick and the tongue large. Pads of fat form below the clavelee, and the subcutaneous tissue generally is soft and mucoud in type (hence the name myxadema), and there is attrophy of the skin structures such as sebaceous glands and hair follicles. The heart-bests are diminished, and the temperature is low.

Such individuals exhibit a marked tendency to infection, notably to tuberculosis, moreover they show a disturbance of carbohydrate metabolism, so that it is almost impossible to produce glycosuna (increased sugar tolerance). The thyroid gland is greatly reduced in size and is characterised by a fibrous strophy in which only a few gland acrin are to be found. This fibrous atrophy may be preceded by a gottrous enlargement or hy an inflammatory process. Very often in elderly people the attents of the gland exhibit a calcarcous degeneration. Whether this is the cause or the result of the glandular atrophy it is impossible to state. The actual cause of the atrophic change is therefore obscure.

Waxy Degeneration occurs occasionally in the diseases which cause amyloid deposits It is associated usually with a gotterous enlargement. The amyloid change is found in the walls of the vessels and in the basement membrane of the sland acrui

Calcareous Degeneration is a frequent complication of goitrous enlargement

Hypertrophy—Under this heading the various types of enlargement of the thyroid commonly known as gottre, struma, or hronchocede may be considered. At the same time it should be stated that there is no very clear line of distinction between these condutions and tumour formations. The enlargement is one which occurs sporadically in most parts of the world, but is much more frequently met with in certain more or less well-defined districts characterised, as regards the geological formation by limestone deposits Such districts are to be found in the Alps and Himalajas in the basin of the Great Lakes in Canada and the United States, and in Derbyshare, England. It is generally recognised that the medium of transmission for the disease is the water supply. Deficient ingestion of sodine will undoubtedly produce the disease, and administration of small quantities

of iodine to school children will as certainly prevent it. There are those who regard the condition as due to an infection of the alimentary tract

The pathology of the disease may be stated as follows Under certain stimuli the thyroid gland undergoes enlargement due to hyperplasia of its gland elements In this state the colloid disappears from the gland alveoli, the lining cells assume a columnar instead of a cubical shape. The walls of the alveols are thrown into folds owing to increase of gland cells and stroma. The stimuli which cause this hyperplasia may be physiological, eg ingestion of certain foods, menstruation, pregnancy (it should be noted that goitre is much more common in females), or pathological, eg infective diseases generally, deficient ingestion of iodine, and the influence of certain others of the endocrine glands, notably the suprarenal On the removal of these stimuli the gland passes into a resting stage in which the alveoli become again distended with colloid, and the conthelium cubical instead of columnar II the stimulus has been excessive, numbers of the alveoli may be permanently enlarged and cystic In this way two types of gostrous enlargement are explained

- T Parenchymatous, best exemplified in exophthalmic goitte, representing the stage of stimulation (for description see below)
- 3 Colled or gelatiness getter, the common type of enlargement met with in gottrous areas, representing the resting stage following stimulation. The enlarged thyroid of the gottrous area often shows a mixture of the two types Such a thyroid is the product of repeated periods of stimulation followed by resting periods. Complications such as hemorrhage, necrosts, cyst formation, birouss, and calcification are common in gottrous thyroids. The cysts may be harmorrhagic, necroite, or merely due to excessive distintion of alt-coll. In this way the advanced form of colloid gottre is produced. The enlargement may be uniform, more frequently.

one side is larger than the other. The surface is nodular owing to the presence of cysts. On section the cut surface has a reddish brown glistening appearance with larger cavities con taining colloid mixed with blood. Areas of fibrosis occur often with opaque-white calcareous depost and even bone formation.

3 Adenomatous gostre, characterised by the occurrence of more or less well-defined rounded nodules pressing aside the glandular substance of the organ These nodules are commonly regarded as tumour formations (adenomata) although a similar appearance is produced by nodular hyperplasia. Two types are distinguished (a) the fatal admona, so named by Bilroth owing to their resemblance to the feetal gland in structure, the alvool being small, containing little colloid, and the stroma poorly developed These are frequently multiple, soft, and of a greysts red colour, (b) colloid admona, resembling the colloid gland in appearance and differing only in forming rounded masses pressing aside the surrounding gland tissue. These tumours are subject to the same complications—hæmorrhage, cyst formation, calcification—as the colloid tyre of gostre—as the colloid tyre of gostre—

Exophthalmic Goitre (Graves' or Basedow's disease) is a condition characterised in addition to the enlarged thyroid, by protrusion of the eyes, increased rapidity of heart's action, flushing, sweating, and tremors The thyroid gland is very vascular and pink in colour The enlargement is uniform, the organ retaining its shape On section the most striking change is a relative absence of colloid, although in gostrous areas an admixture with the colloid goitre is common. The surface has more the appearance of a gland such as pancreas, owing to absence of colloid. Cysts may be present, but their content is mucinous rather than colloid.

The most striking alteration under the nucroscope is the relative absence of colloid in the gland alveol, which therefore appear to be collapsed Instead of the colloid which stains with the acid dye there may be a small quantity of granular material often staming with the basic dye. The epithelial cells are columnar instead of cubical. Projections of stroma covered with epithelium occur into the alveoli, which thus vary very much in shape. There is often shedding of the epithelial cells into the alveoli. The vessels of the stroma are prominent and filled with blood.

In fatal cases of the disease, in addition to the enlarged thyroid there may be found enlargement of the thyrmis gland, endocarditie sepecially of the mittal valve, percarditis, enlargement of the spleen, lymphatic and hemolymph gland, erythroblastic marrow associated with anzimia of a chlorotic type, lovertrophy of the left ventrale of the heart.

The condition is a hyperplasia of the thyroid gland, a parenchymatous gottre as stated above, in which the stimulus to increased action is as yet unknown. One of the most reasonable suggestions is that it is connected with the activity of the superrated cland.

Inflammations of the thyroid gland (Strumins) are not very common. They may occur in the course of infective disease such as typhoid fever diphtheria and septicenmas. They may be due to extension of an inflammatory process from neighbouring parts. Larger or smaller abscesser may form and the condition may be followed by fibrosis and fibrous attrophy. Chronic inflammatory processes are met with in syphilis and in tuberculosis. Any of these chronic changes may produce the fibrous attrophy of myrocderms.

Tunnorrs.—These have been dealt with in part under the heading of hypertrophy. Simple admonate are among the commonest. They occur chiefly in relation to goitrous enlargement. It is difficult to draw a line between them and nodular areas of repenention. The fextal adenoma already mentioned is believed by many to arise from embryonic rests situated in the stroma of the gland (Wolffley). Papillary admonats occasionally occur. Other simple tumours—fivone, estimate, and tertaines—are rare Centromatals are

fairly common, especially in glands the seat of gottrous enlargement. Such tomours are peculiarly apt to metastasize in bones, more especially those of the face and thorax. They may be spheroidal cell, acinous, or papillary in type Sarcomata of various types occur. Hæmangiosarcomas and endotheliomas are desembed as comparatively common.

DISEASES OF THE PARATHYROID GLANDS

The parathyroids, of which there are usually two on each side in close contact with the thyroid gland, are minute glands 6-7 mm in diameter, with a red brown or yellow brown tinge. They consist of masses of epithelial cells with occasional colloid containing alweol. Two types of these cells are distinguished, viz thief cells and expfhil cells. Supporting these there is a vascular stroma. Excision of all four glands gives rise in animals to fatal telany. A similar condition may be produced in man by extirpation. The chief symptoms in tetany is a contraction of the muscles which in man is tonic in type.

Little is known about the pathological anatomy of the glands Hæmorrhages into the glands are probably the most important pathological conditions. These sometimes occur at birth, probably through injury. On healing the condition may be followed by symptoms of tetany.

Hypertrophy of the glands occurs after experimental removal of the thyroid gland — It also occurs in osteomalacia and other diseases

Tumours are rare They are usually simple adenomas, and are often discovered quite accidentally at autopsy

DISEASES OF THE THYMUS GLAND

Like the thyroid this gland varies considerably in size, but the variations are chiefly physiological, depending upon the age of the individual At birth the weight is about 13 gm, from the first to the fifth year about 23 gm, from the sixth to the twenteth year about 25 gm, and from then onwards the gland atrophies until after the thirteth year 11 is scarcely possible to weigh it with any degree of accuracy. If after this age the gland is easily demonstrable a pathological condition is present.

Attrophy —As stated above, after the period of exual maturity the gland undergoes a process of progressive attrophy. This is more than a mere wasting of the gland. It is due to a disappearance of the tissue proper, particularly the cortex, with a relative increase in Brones stream. In children in diseases associated with wasting in starvation, and in chrome infections such as tuberculosis and syphilis, an attophy particularly of the lymphatic tissue is observed. The Hassal corpusales become more prominent on account of the disappearance of the intervening tissue. This is accompanied by an increase in the connective using

Hypertrophy — Under this heading may be mentioned arrested miolution of the gland or persistent thymus as well as actual enlargement. Hyperplasia of the gland tissue is stated to occur in a large proportion of cause of exophthalmic goitre, in Addison's disease, soromegaly, and in my anthenia gravis. The relationship of this enlargement to these diseases is still obscure. In a number of cases of unexplained sudden death the gland has been found to be persistent or actually great (wince the normal or more) to explain death by the interference with respiration. In many no such considerable enlargement is present, and some pathologists believe (although actual proof is wanting) that there is some connection between the enlarged dan and surden death.

This persistent or enlarged thymus gland is connected with the condition known as status lymphaticus or thymolymphaticus (see p. 123) Hemorrhage —Punctate hemorrhages are frequently observed in the thymus of the new born child Similar small hemorrhages occur in young children dying of infectious diseases such as pneumonia Larger hemorrhages also occur in the new born, and are specially frequent in congenital syphilities

Inflammatory conditions of the thymns are not un common Pyzems abscesses, syphilus gummata, and tuberculous lessons all occur Occasionally the enlargement associated with these conditions may sensitively interfere with respiration

Tumours are rare It is questionable whether the lipoma occasionally found in the anterior mediastinum has anything to do with the gland itself Cysts are not infrequent and myxomata are described, but the most important tumours are mailignant. Such tumours are usually composed of round cells which resemble the larger cells of the thymus cortex. They were originally described as sarromas, but it is probable that they are epithelial in nature. These tumours rapidly metastasse by the lymph channels. True sarromata also occur and teratomata

DISEASES OF THE SUPRARENAL GLANDS

The two suprarenals together weigh eight to eleven gm in the adult. They are beaver in the male than in the female, and relatively much larger at birth than later on in life. The reduction in size after birth is due to a disappearance of the inner cortical layers, apparently to make room for the rapidly developing medulla. Each gland is composed of two organs distinct in origin, structure, and function. The cortex, forming a yellow min to the glands, arises firm a portion of the mesodermal ridge. It is composed of epithelial cells arranged in columns and commonly filled with globules of lippoid material—cholesterine exters and ordinary fats. Beyond the

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found almost completely destroyed. In by far the larger number (75 per cent) the destruction is due to a chronic fibro-caseous tuberculosis, frequently (17 per cent) the only tuberculous lesion in the body Cases have been described in which fibrous atrophy, hamorrhage, syphilitic gumma, and tumour have been the causes of destruction. In about 12 per cent of cases no lesion of the suprarenal is present. In some of these, lesions (inflammator) infiltration, pressure by tumour) of the chromaffin tissue of the sympathetic system (semi lunar gangha, etc.) have been found. The question armes as to whether the cortical or medullary lesion is most important. In most cases in which the glands are affected the destruction is almost complete, but it would seem that the medullary portion is the most important. In other words, the disease seems to be due to destruction of the chromaffin tissue of the body either in the suprarenal gland or outside it Another interesting observation of recent date is that in a large proportion of cases of Addison's disease a general hyperplasia of the lymphadenoid tissue (status lymphaticus) is present.

Tamours—Simple advisorar composed of cortical substance are common. They form small rounded rodules with the characteristic yellow colouring of suprarenal cortex, and are composed of cells differing in no essential point from the normal. Growthe of an epithelial nature of large size with a similar yellow colouring, but with a tendency to necross and hemorrhape, are also common in the utuation of the supra renal glands. Such timours if removed early may not recur, but if left they metastasses into the lung pleura and other internal organs. To this group the term hypersephrene has been given. They are more common in the kidney than in the suprarenal, and many regard them as originating either from the suprarenal or from embryour rests in the kidney. This view, depending upon their colour and the feamy character.

of the protoplasm of their cells, is not now so generally held (see p 290)

Tumours of the medulla are also met with arising either from the nerve elements (neuroblastomas) or from the chromaffin cells (paraganglomas). The neuro hlastomas were formerly placed in the categories of round cell sarcomas and glomas, but the recognition in these of fine nerve fibres has placed them amongst the tumours of nerve origin.

DISEASES OF THE PITUITARY BODY

The normal gland is about the size of a hazel nut without the shell The weight in the adult is a little more than half a gramme, during pregnancy it may rise to one gramme. It is situated at the base of the brain in the sella turcica of the sphenoid bone, and it is connected with the floor of the third ventricle by a short funnel shaped stalk-the infundibulum This expands into the posterior portion of the body, the pars nervosa, which is mainly composed of neuroglia fibres and cells. The antenor portion lies in front of and nearly surrounds the posterior It is much more vascular, and is composed of epithelial cells arranged in a reticulum. Some of these cells are large and show affinity for acid dyes such as eosin (acidophil), others are basophil, others again show no special affinity of dyes. Between the two lobes is a cleft usually broken up mto small isolated spaces in the adult In connection with the posterior wall of the cleft is the pars intermedia of the gland There is no definite line of demarca tion between this and the posterior nervous portion, but it is separated from the anterior lobe by the cleft. The pars intermedia is composed of epithelial cells forming acini which may contain colloid material. These acini increase after thyroidectomy

No active principle has been isolated from the anterior

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lobe but it probably secretes a substance which passes into the blood and which exerts an important influence upon metabolic processes and growth especially of the skeleton. The effect of extracts of the postenor portion is complex, amongst other results is a lowering of the sugar tolerance.

It is extraordinarily difficult to study the pathology of the gland owing to the close connection of what are really two distinct organs lying in a small bony space. Thus enlargement of the one organ will inevitably compress the other The following statements may be made with a fair degree of probability.

- I Hyperaturity of the anterior lobe before epiphyseal estaffaction is completed induces an exaggerated growth of the skeletion and other tissues of the body, the individual becoming a guait (escantism). At the same time there is sexual importance and a high sugar tolerance. In a case of this kind which came to autopsy the hypophysis was small and converted irto a cyst. Apparently the hyperactivity had passed unto an atrophy
- 2 Hyperactivity of the antensor lobe in later hip produces the syndrome usually known as aromnealy. In this condition the bones of the tace hands, and feet are enlarged, and the soft parts greatly thickened. The lower pay projects so that the face resembles that of a horse. There is a honormal growth of the hair which is long and coarse. There may be glycosuris for a time but later on, owing to impaired gland functions, there may be high sugar tolerance associated with obesity and sevual impotence. Fatal cause of this disease show an enlargement of the gland which may be merely hypertrophy or may be due to an adenoma. How ever, not every tumour of the printiary is accompanied by symptoms of acromegaly, because such growths may be destructive form the Enginang.
 - 3 Iractivity of the anterior lobe commencing before puherty

causes changes similar to those seen in pupplies after hypophysectomy, viz stunting of growth, great obesity, a condition of high sugar tolerance, and failure in development of the sex gland: What is known as Froblich's syndrome or adposogenitals is apparently the analogous condition in the human subject the result of disease. It is a condition characterised by an excessive accumulation of fat, an imperfect development of the sexual organs, also, frequently, polyuna (diabetes insipidus). In the male the body takes on the feminine hibitus with large breasts, knock knees, and absence of beard.

4 Inactivity of the anterior lobe in later life is associated with obesity, high sugar tolerance and polyuma and a gradual loss of sexual function

Owing to its peculiar anatomical situation enlargement of the pituitary from whatever cause, inevitably produces secondary symptoms of importance. Because of the un yielding bone below and around enlargement occurs in the first place upwards with bulging of dura mater covering the sella turicia. Soon excavation of the bone occurs by a process of pressure atrophy, the optic nerves become involved at the chasma, and pressure symptoms appear in connection with the brain

The various causes of enlargement are (1) Hyperplana, a constant occurrence in pregnancy and after castration. It occasionally occurs in myxedema, cretiuism, and after thyroidectomy (2) Stuma, a condition of simple uniform enlargement of the anterior lobe due to prohiferation of its cells. All of the three types of cells are present. It is probably a hyperplasia rather than a tumour. It causes enlargement of the selfa, but the gland is not adherent to the bone. It comes second to adenoma in frequency in cases of acromingally and Frobchs syndrome. (3) Admenias occur in the anterior lobe in its central portion. They vary much in size and many or may not lead to an enlargement of the

gland as a whole They are composed of epithelial cells conforming to one of the types normally present. These tumours are present in the large proportion of cases of acromegaly (4) Carcinomas originate also in the anterior lobe They invade and erode the bone but do not as a rule produce metastasis They are occasionally present in acromegaly and in Frölich's syndrome The structure differs in different cases, and often in different parts of the same tumour (c) Sarcomas of various types are occasionally met with, and also account for a proportion of cases of acromegaly and Frolich's syndrome They are often difficult to distinguish from the carcinomas (6) Cysts originating from the cranopharyngeal duct are not infrequently found in cases of Frolich's syndrome (7) Teratomas and metastatic malignant growths are rare causes of enlargement. Other lesions of the pituitary occasionally met with are pyogenic foci, guramata, and tuberculous lessons. These are rarely associated with symptoms referable to the gland Embolism and infarction are not uncommon occurrences, and may cause symptoms such as are associated with destruction of the anterior lobe

DISEASE OF THE PINEAL GLAND

Lattle is known of the function of this gland, although apparently it belongs to the endocrine group. It is about half the size of the pituitary, and is relatively larger in children than in adults and in the female than in the male. After puberty the gland undergoes retrograde changes, although its epithelial elements persist into old age. Small rounded masses of calcarrous material are constantly present and tend to increase as age advances.

The only important pathological condition hitherto recognised is tumour formation. The commonest turnour is a teratoma, which always occurs in young males, and which may noduce admormal growth of the skeleton, sevual precogity. and early development of secondary sex characters. Marked increase of subcutaneous fat is also usually present. Other tumours not commonly associated with the above symptoms are glomata and carcinomata. Cysts are also occasionally met with.

CHAPTER VII

DISEASES OF THE RESPIRATORY SYSTEM

DISEASES OF THE NOSE AND ASSOCIATED

Inflammation. - Although unimportant in itself, inflam mation of the nasal cavity or thinitis may assume importance through extension of the inflammatory process to the accessory sinuses such as antrum, frontal, ethmoidal, and sphenoidal sinuses, also by way of the Eustachian tube to the middle ear and mastered antrum. Such cavities should be examined at the autopsy in the way indicated (p 42) The commonest one to show pathological change is the middle car, and this should invariably be investigated. Acute inflammation is at first of a catarrhal type with secretion of much watery mucus. In the more intense inflammations fibrin occurs and the exudate becomes tenserous and difficult to get rid of. As the process subsides leucocytes in large numbers emigrate from the vessels, the exudate becoming thicker and more opaque In such situations as the antrum, tenacious or thick exudate may obstruct the exit and an abscess or empyema result.

Hyperplasia of lymphoid tissue or adenoids is a common condition in the naso-pharynx, especially of children. It is associated with repeated attacks of rhimits, and causes obstruction to masal respiration with consequent mouth breathing, and sometimes malformation of nose and chest Adenoids form rounded pink masses of firm consistence which show on microscopic examination the ordinary structure of lymphond tissue. Occasionally they are the seat of a tuber culous infection

Tumours—The commonest tumour in this situation is the nesal polyp, which, although often classifed as a fibroma or myroma, is probably merely pendulous and ordematous mucous membrane. Such growths are often associated with asthma and are frequently multiple. Other tumours in this situation are sarromas and carcinomist, but both are much more common in the tousillar record.

DISEASES OF THE LARVNX

Edema, also called cedema glottidis—This may be due to the swallowing of boding water, to acute inflammation in the neighbourhood, eg acute tonsilitis. It may also occur in association with kidney and heart disease. The parts most affected are the posterior surface of the epiglotis, the aryteno-epiglotic folds, and the false cords. The condition is serious, from its interference with respiration. It shows itself by swelling of the parts affected, which are pale and have a translucent appearance.

Laryngitis —Acute and chronic catarrhal conditions of the larynx show little that is obvious after death There may be hyperæmia and collection of mucus

Membranous Laryngitis — This is most commonly diphthentic m origin, although it may be due to streptococcal infection. It may occur in the course of other specific

fevers, such as typhoid and smallpox. It occasionally is caused by the presence of foreign bodies, such as fish bones. The membrane usually occurs also over the tonsils and pharynx, and may spread downwards into trachea and brouch. The membrane is commonly firmly adhrent in the pharyngeal region. In trachea and brouch it is easily removable (Fig. 44). The membrane has a white or grey appearance, and the subjacent ussue and surrounding parts are acutely congested.

Taberealosis of the LAYERK.—This condition is usually secondary to pulmonary tuberculosis. It is characterised by the deposit of suberculous granulations, with subsequent ulceration. The ulcers are found over the epiglottic, anyteno-epiglottic and inter arytenoid folds. At first superficial, they tend to extend deeply, croding the vocal cords, and even the cartilage in the neighbourhood. The margins of the ulcers are raised and nordiar.

Exphilis of the Larpex.—This may occur both in hereditiny and in acquired syphilis, and both as a secondary and tertiary manifestation. In the secondary stage estartal inflammation and miscous patches occur, in the tertiary stage gummatic, ulceration, and subsequent centration and attentions. Ulceration, when it occurs, tends to destroy cartilage as well as soft parts, such as the base of the tongue and pharyex.

Tumours of the Larynz. — Among simple tumours, papillomata and fibromata occur. Of malignant growths, carcinomata are more common than sarcomata.

DISEASES OF THE BEONCHI

Asthma.—Although not commonly a serious disease, asthma does occasionally prove fatal. In such cases the

bronch are found contracted and blocked by tenacious plugs of mucus which on microscopue examination sbow, in addition to shed epithelial cells, large numbers of cosmophile leucocytes The Curschmann's spiral is an elongated plug of this kind The lungs generally show an extreme condition of emphysema, and the other organs of the body are intensely concested.

Microscopically, the mucous membrane of the bronchi is folded through a contraction of the bronchial muscle. There are found in this way deep indentations or diverticula. The basement membrane is hypertrophied, the epithelium shed, and the subepithelial tissue intensely congested and infiltrated with cosmobile leucocytes

Acute Bronchitus — Inflammation of the bronchi may be caused by many different organisms, e g sishhylococa, streplococa, pneumococcus micrococcus catarrhalis. In addition, irritating lumes, such as those of ammonia, may produce it Inflammatory conditions of the smaller bronch are often accompanied by inflammation in the contiguous portions of lung (broncho pneumonia)

The appearances in acute bronchitis are swelling and congestion of the mucous membrane, with the presence of a fibrinous or purulent exudate. When the bronchi within the lung substance are affected, squeezing of the lung expresses beads of purulent material.

Microscopic Appearances —The most strking change is desquantation of the chited epithelal cells, which are found lying free in the studate along with polymorphonuclerate leucocytes — The basement membrane upon which the epithelial cells rest is swollen. The underlying vessels are congested, and the surrounding itsue infillrated with in flammatory cells — The cells of the mucous glands are swollen and granular.

Bronchits due to authorax infection, known as "Woolsorter's disease, presents certain peculiarius: The inflammation is of a hemorrhagie type, and implicates the bronchial and mediastinal glands and tusine as well as the bronch themselves. Areas of necrosis occur which shows infilitation with polymorpha, red cells, and fibria. The characteristic bacilli are to be found in the secretion in the bronch, in the bronchial wall, and in the glands. The lung tissue itself is not as a rule affected to any extent. It shows merely congestion and ordema.

Offronie Bronehitis.—This condition may be organismal, following the acute form, or it may be associated with the occupation, the individual working in an atmosphere in which there are many foreign particles, e.g. carbon, stone, steel, etc. In appearance there may be hitle alteration from the normal. Sometimes the lumen of the tubes is dilated. The mucous membrane may be pale or congested Occasionally there may be superficial ulceration. There is always a considerable amount of frothy muce-purulent secretion in the tubes, which may show more or less pigments too from the presence of foreign particles. The credition is usually accompanied by emphysican of the lungs, and often by dilatation of the right side of the heart.

Misratoph ally the epublishm, when present, is of a cubcal rather than of a columnar type in places the epublishm may be entirely absent. The basement membrane is often thickened and the subjectent issue indiffrared with inflammatory cells of a small, round, lymphocyte like type There is seadily overgrowth of throug struce, and structures such as bronchial muscle and mucous glands may be atrophied. The lumen of the tubes coust not desputionally designed that the columns of the colu

Tuberculous Bronchitis. — Tuberculous lessons of the larger bronchi are not commonly met with, although tubercles

may develop in the mucous membrane and subsequently ulcerate Lesions of the smaller bronchi within the lung are common in pulmonary tuberculesis. Perborochial tubercles may break through into the lumen of the tubes and lead to ulceration. The smaller bronchi not infrequently dilate through weakening of their walls by inflammatory change Such dilatations may form the starting point of cavities.

Syphilitic Bronchitis.—Gumma formation, with subsequent ulceration, although uncommon, is met in the larger bronch, usually at their commencement, and in the trachea at its bifurcation

A number of cases of sudden death from hæmorrhage through erosion of a large vessel (pulmonary artery, left bronchial artery, superior vena cava) by such an ulcer have been recorded

Bronchiectasis, or dilatation of the bronch, is usually met with in connection with an interstitial pneumonia (tuberculosis, syphilis). The dilatation roay be fusiform or saccular. It is produced by traction on the part of the contracting fibrous tissue in the neighbourhood together with adherence of the lung to the chest wall. A generalised dilatation of the bronchi roay follow collapse of a lung.

Bronchiolectasis, or dilatation of the bronchioles, is a common occurrence in broncho pneumonia, more especially in children. The walls of the tubes, weakened by the in flammatory process and under pressure from within through coughing, distend as a rule the amount of distention is small, but in certain cases it may go on to such a degree that large cavities are produced in which secretion accumulates Such a conduction has been called "honeycorob lung."

DISEASES OF THE LUNGS

Collapse —A lung which is not consolidated, and which is not held in position by adhesions between the two layers

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billies pieura, the moment that the pieural cavity is opened collapses to about one-third of its bulk. Such lungs are therefore always observed in this semi-collapsed condition. A similar condition, or one which is more complete, may be produced during life by the presence of air in the pleural ravity, or from drops cal or purulent fluid in the sac. In such a case the lung is of a slate-grey colour (Fig. 41), animine, tough, and sinks in water. On squeezing, few or no air bubbles can be expressed from the cut surface. If the collapsed condition have persisted for long, there will be overgrowth of librous tissue, and sometimes dilatation of the bronch. If adhesions bind portions of the lung to the narietal pleura, the collapse will be pertial.

Collapse of small portions of lung is often observed post morten, more particularly in the lower and posterior parts of the organ. These appear as dark purple areas slightly depressed below the general surface. They can be reinfiated by pressing are into them from neighbouring parts.

Similar small areas of collapse are found in cases of bronchopneumonia. They are due to blocking of the smaller bronchi with exudate, and the subsequent absorption of the air by the blood

Localised collapse may also be found in the lung in the neighbourhood of aneurysms or tumours pressing directly upon the lung

Microscopic Appearances—The siveolar walls are relaxed and approximated. The vessels are usually dilated. There may be evidence of catarris in the aircoi. Increase of fibrous tissue may be observed. The clastic tissue appears to be increased, but that is merely because of the relaxation of the long substance and the condensation of the fibres.

At electasis —This is a condition similar to the above, which may be found in the new born child, but as it is due to want of expansion, the term "collapse," although sometimes used, is scarcely applicable. The condition may be

complete or partial. When partial, it is commonest in the lower lobe, especially in its posterior part. The organ which is the seat of the change, metered of being pale pink and crepitant, is dark red, tough, and airless. If the condition is partial, the area affected is depressed below the nir-containing portion. The affected portion sinks in water (see p. 392)

Emphysema —Two varieties of this condition are found in the lung (r) vesicular emphysema, or over-distention of the air vesicles of the lung, (2) interstitial emphysema, or the escape of air into the fibrous supporting tissue of the lung

(1) Vesicular Emphysenia - This is a condition of over distention of the lung alveoli caused by (a) forcible distention of the air vesicles from constant coughing, as in chronic bronchitis, or from the blowing of wind instruments, (b) the giving way of the elastic network of alveolar walls before a normal pressure, this may be due to wasting disease, to old age, or to an inherent imperfect development of the tissue The portions of the lung most affected are the apex. the anterior and lower borders, that is to say, those portions where over-distention can occur most readily The lung is pale (Fig 40), light, and has a spongy feel, like the sensation given on pressing a bag of feathers On section, it is dry and bloodless There may be areas of very marked dis tention forming small bladders or bullee. The condition is usually associated with chronic bronchitis and enlargement of the right side of the heart. Hypertrophic and atrophic forms of emphysema are distinguished, in the former the organ is more voluminous, in the latter it is smaller than usual The hypertrophic type is found in cases where forcible distention from coughing is the cause, the atrophic type in cases of wasting disease in old age, or where the elastic tissue of the organ is naturally imperfectly developed

Complementary or compensatory emphysema is found in

small areas of lung in close approximation to areas of collapse or to areas of shrinkage from fibrosis. This latter type, found in the neighbourbood of healed tubercle foci, may be called traction emphysima (p. 182).

Microscopic Applearances —There is marked over distention of the air vesicles and smaller air passages. The smaller vessels have, to a great extent, disappeared. The elastic fibres of the alseolar walls are stretched and widely separated. The bronch may show evidence of chronic catarth.

(2) Interstitual emphysicums is a rare condition when, owing to rupture of the lung from injury (e.g. fractured rib, stab, or bullet would) or disease (e.g. Rangeron, emphysema), the air escapes into the fibrous supporting tissue. In this position it works its way to the root of the long, and eventually into the mediastitum and arendy tissue of the neck.

CIRCULATORY CHANGES

Acute Congestion or Hypersmin.—The condition is usually found preceding or associated with inflammation of the lung. It will be described in connection with meumonia.

Passive Congestion or Hyperzmia. -- Two varieties of this condition may be distinguished

r Hypertaine congention, a condution frequently found post mortem, more especially in cases where the circulation has been slowly failing. As the name indicates, it is in the posterior parts of the lung (the parts where gravity has most influence on the blood) that the condition is most marked. The area involved is dark purple in colour, and is often the seat of cedema and inflammatory consolidation;

2 Chronic Veneux Congestion of the Lung—This occurs where there is long-standing obstruction to the passage of the blood through the lungs, as in cases of chronic radual disease of the left side of the heart. The organ is of a dark red, sometimes brick red colour, and in the later stages it is of firmer consistence, hence the term "brown induration" Not infrequently infarcts are present in such lungs

Microscopic Appearances —The vessels generally are dilated, and, in the case of the alweolar capillanes, they project into the interior of the air vesscles and are obviously thickened. Red blood cells may be found free in the spaces, also shed endotherial float of the cells containing pigment derived from broken down red corpuscles. Catarrhal changes will also probably be found in the bronchi and there may be some increase of fibrous under the microscope. In the hypostatic variety cidema and more acute inflammatory changes may be present.

Hæmorrhage into the lung substance may occur in the form of minute petechnal hæmorrhages usually under the pleura. Such are found in severe anximas, in cases of death from suffocation, and in infective conditions. Larger hæmorrhages are found in infaction, in severe inflammations, and in gangerie, also sometimes in tuberculosis.

Embolism of the pulmonary artery is one of the commonest causes of sudden death. In all such cases the main artery and its branches should be carefully investigated for the presence of thrombi (p 25). This thrombus may come from a varicose vein in the leg, from a uterine vein after parturition, or from a vein in the neighbourhood of some operation area, particularly in the abdomen, e.g. after removal of fibroids from the uterus. Should a large branch of the pulmonary artery be blocked death occurs with startling suddenness, often on the patient sitting up in bed. Blocking of smaller branches does not cause immediate death, so that the changes associated with infarction have time to occur

Infarction (Pulmonary Apoplexy)—This is a common condition to find in lungs the seat of chronic venous congestion. When the area of lung involved is large, the condition may be the cause of sudden death. The causation of the condition is not quite clear, as it is difficult to produce

infarction experimentally by the injection of artificial emboli. In a majority of cases, however, the artery leading to the area will be found plugged with an embolus, and on careful examination a source will be found for the embolus, ϵ_S a thrombus in the right auricular appendix or in a vein (see diagram, p. 60.) Another view of the causation is that it is due to thrombosis in the vessel, not to embolish. Another, that it is merely due to escape of blood from a burst capillary into the spongy tissue of the long

The condition is more frequently found in the lower lobes than in the upper It occurs specially at the margins of the lung (anterior and lower) and towards the surface, not in the substance.

The area involved is more or less angular (Fig. 45). It is raised above the general surface of the organ, that is to say, it remaine distended when the neighbouring long undergoes partial collapse. It is usually dark purple in colour and hard in consistence. Occasionally it may be pale from subsequent decolorisation. Sometimes a rone of fibrour tissue develops around the infarct, and the area may undergo softening or it may centrue. Infarctio of the lung, however, seldom show the later changes found in infarcti electhere. This is no doubt partly due to the fact of the double blood supply of the lung. It is also due to the fact that many of the infarcts occur shortly before death, and in sorce instances are the actual cause of death.

Mississipic Afficiants:—In the trea mysled, the alreal are filled with red blood cells and fibrin, or, in other words, with blood clot There are also leucoyies present, more especially at the margin. The cells of the alreadar walls show some loss of statungs reaction, but acresise changes are rot frequently found in infarts of the lung. There may also be a declopment of fibrous issues round the area.

Edema.—This is an exceedingly common condition. It is found in cases in which droppy tends to occur elsewhere, as in heart disease and in Bright's disease. It is also very

commonly present in cases where death has occurred slowly, as in ususing diseases, e.g. cancers, ansema. It is frequently combined with hypostatic congestion, and tends to occur in the more dependent portions of the lung. Thus it is more frequent in the posterior portions of the lower lobe. Occasion ally, however, it is most marked in the upper lobe. Eddema frequently occurs in the neighbourhood of pneumonia careas. The organ is pale unless congestion is superadded. It is bulky and feels fairly solid, but, unlike a pneumonia lung, it pits on pressure. When one cuts into it and presses the lung substance, frothy fluid escapes.

Microscopically, the alreols are found distended, their contents being finely granular material, which is all that is left of the albumnous exudate after the tissue has been fixed, bardened, and cut. Catarrbal cells and leucocytes are also usually present within the also col-

INFLAMMATIONS OF THE LUNG-PNEUMONIA Prenmonia-General Considerations

Irritant particles and pathogenic germs may reach the lung substance by several different channels. The most obvious path is of course the respiratory tract. It is, however, by no means an easy matter for foreign particles to enter the ultimate air cells or even the smaller bronche. The greater proportion of them are strained off in the nose and upper air passages. That it is possible under artificial conditions to introduce bacteria and carbon particles into the terminal air sacs has been proved, but under natural conditions the moist walls of the channels, constantly narrowing and frequently changing direction, seize and retain the greater number These retained particles are then wasted upwards by the action of the ciliated epithelium lining the tract, and are eventually expectorated This action on the part of the ciliated epithelium is interfered with and may be suspended as the result of catarrh. Hence probably the increased susceptibility to tuberculosis following such conditions as measles. There is, however, a tendency for a bacterial infection, once it is started,

in one part of the tract to spread downwards by continuity of surface. Thus many cases of bronchitis and pneumonia are preceded by a catarrhal process higher up in the tract.

Another avenue by which infection may reach the lung is the lymphatic system. An infection originating in the mediastinal glands and tissue may pass in a rad ating fashion into one or more lobes by the lymphatics, eventually implicating the lung substance.

Again, germs may reach the img by the blood setting up what is known as enbotic preumonia. This is probably not a common avenue of infection, but it occurs not infrequently appropriate particularly that caused by middle-car diesase with subsequent thrombons in the lateral sinus and that associated with restormentation.

Lastly, germs may reach the lung by direct continuity of tissue, from infections in pleura, liver, peritoneum, rib, neck, etc.

Owing to the peculiar structure of the luog-a honeycomb of minute cavities-inflammation is always associated with consolidation. This consolidation is due to a filling up of the air spaces with some exudate containing cells in larger or smaller quantity. The more intense forms of inflammation, notably those produced by the pneumococcus, are characterised by fibranous (croupous) esudate infiltrated with polymorphs. A hamorrhagic exudate is associated with acute influental pneumonia. In the less acuse types of pneumonia and at the periphery of areas of lobular pneumonia, also in the catarrh of passive congestion, the cell elements are mainly of the so-called catarrhal type. These large monounclear cells which also occur characteristically in tuberculous pneumonia are derived in part from the lining cells of the alveoli, but also in farce part, as has been recently po nted out, from a prolifera tion of the endothelial cells of the inter alveolar blood vessels

The different types of pneumonia are named partly according to the type of zendare which is associated, e.g. cataribal, croupous (another name for fibrinous), partly according to the distribution, e.g. lobar, lobular, partly according to the causal germ, e.g. pneumococce, midenail, tuberculous.

Of all the organisms found in acute pneumonia, the pneumonoccus is the commonest. It occurs either by itself or in association with other germs, such as the inducenta virus, pneumohacillus, tubercle bacillus. The pneumococcus is now recognised as forming a group of closely alled germs, of which

there are four types Three appear to be definite varieties and are known as Types I, II, and III Type III is also called the pneumococcus or streptococcus macossus, on account of its well-developed capsule. It is a specially virulent type type IV represents a collection of strains which do not fall into one or other of the first three categories. They are relatively non pathogenic. The strains separated from saliva and normal throats usually belong to this group. Some cases of acute pneumonia such as those following either anacthesia may be caused by organisms of this type.

Types of Pneumonia

A Acute Pneumonia

- r Lobar pneumonia (croupous pneumonia)
 2 Lobular pneumonia (catar
 - rhal or broncho-pneu monia) 3 Purulent (septic) pneu
 - monia)
 4 Hypostatic pneumonia.
- B Chronic Pneumonia
 5 Interstutial, following acute
 - 6 Pneumonia due to inhala tion of dust particles (pneumokoniosis)
 - 7 Pneumonia due to chronic ally acting bacterial poisons (tuberculous and syphilitic pneumonia)

1 Acute Lobar Pneumonia

This condition, also called Croupous Pneumonia, is so well defined that it may be called a specific disease. It is due in the wast majority of cases to the diplococus pneumonia. This organism is accompanied not infrequently by B pneumonia, streptococa, starptococa, B vigluenza, B typhosiu Occasionally these organisms are present by themselves

The condition, as its name indicates, is one which usually involves the whole or the greater part of the lobe of a lung. The ingit lung is more frequently the seat of the disease than the leit, and the lower lobe than the upper lobe. Not infrequently the whole of one lobe and a portion of another lobe may be affected, and less frequently both lungs may show the change. Orth gives the percentage of involvement of the two lungs as follows—right, 52, left, 33, both lungs, 15

the two lungs as follows — right, 52, left, 33, both lungs, 15

The term croupous is applied because of the type of exudate present in the lung alveoli, which is essentially fibrinous

For reasons of convenience it is customary to divide the process into four stages (1) stage of active hyperamia or acute congestion, (2) stage of red hepatisation, (3) stage of grey hepatisation, (3) stage of residution. The distinction between these stages is an entirely artificial one. Frequently more than one of them are to be observed in one and the same lung. By themselves the first two are rarely seen, owing to the fact that death does not often occur during the early stages of the disease. They are, however, not infrequently seen in areas of the lung in which the later stages are present in neighbouring parts.

(i) Stage of Acute Congestion —As regards the naked-eye appearances at this stage there is little more to be observed than a bright red colour in the lung substance on section. The lung substance is still crepitant and spongy

Afterstophs Aftersance — The vessels of the lang generally, and the equilates us the wall of the alterious partnersh, and detended with blood. This condition of the capillanes are a bended appearance to the valls of the air resulter Vithin the lamen of the vessels may be found a few red blood caugustles, a few catarthal cells thrown of from the wall, and a minute quantity of evudate Suitably stained specimens may show getting.

(2) Stage of Red Hepatinians Roked ope Appearances— Thungs is stituteded and contrasts markedly with the semicollapsed condition of the ordinary long. Not infrequently the markings of the ribs may be seen. There is usually some slight amount of fibraness exades over the area of long involved. In consistence the organ is firm, like a solid organ such as the liver. It cuts readily, quite unlike the soft, yielding, unconsolidated long. The organ is immensibly increased in weight. A small portion removed and placed in water at more such.

The cut surface of that portion of the lung which shows the change has a reddish colour, which, on account of its being mottled with paler areas and accumulations of black proment, has been compared with red granite Usually the cut surface, more especially the paler areas, has a granular appearance, owing to the projection of plugs from the alveoli On squeezing the lung substance, only a little blood and serous fluid, but no air, can be expressed Those portions of lung not actually consolidated may show congestion, and sometimes ordema

On opening up the bronchi their mucous membrane is found swollen and injected and their lumen filled with stricky rust-tinged exudate The bronchial glands are swollen and pink in colour

Microscopic Apparances —Instead of the fenestrated appearance of the normal lung section, the lung which is the seat of this change appears like a solid organ. The alveoli are filled with plugs consisting of a network of fibrin threads, sometimes communicating with the congulum in a neighbouring vesicle through one of the stomata. In the meshes of the fibrin are cataritat cells, a few red blood corpuscles, and considerable numbers of leucocytes, chiefly of the polymorpho nuclear type. In suitably stained specimens organisms can usually be found.

In the walls of the alveolt the vessels are still distended with blood. The hronch sbow evidence of acute inflammation. The interlobular septa and the supporting fibrious tissue of the lung generally are swollen and infiltrated with fibrin and leucocytes. The pleurs shows the changes of acute inflammation. Films made from the bronchial exudate will show leucocytes, fibring, designanted epithelum, both flattened and columnat, and characteristic germs. This last is the best source from which to demonstrate the pneumococcus.

(3) Stage of Grey Hepatisation Naked eye Appearance— The organ is distincted as before, shows in markings and fibrinous esudate on the pleura over the affected lobe. As before, it is firm, heavy, and a portion removed sinks in water. The cut surface, however, is pale, and, with the black mottling of the carbon, is not unlike grey granute in appearance (Fig. 42). The granularity of the cut surface is more marked, and, on scraping the surface with a lande, turbed fluid and plugs from the alveolt can be removed On squering, similar fluid can be expressed, but no air-bubbles On opening up the bronchist the mucous membrane, as before, is found to be swollen and impected, the contents have a more opaque white appearance.

Misoscopic Afferances —The alveols and smaller air passages are filled, as before, with plugs, which are, however, at this stage retracted from the walls, this space having been filled during life with fload. The fibrin threads are not so obvious, they are broken down and granular. In the methies of the coogsilum are sastly more numerous cells, the increase being entirely due to the accumulations of polymorphonuclear feucocytes. Many of these stain baddy owing to degenerative changes. Germa are often difficult to fird at this stage. The capillaines in the walls of the alveola are, to a large extent, oblicanted by the pressure of the contents of the air vesselse. Brooch, interhobular septs, and pleura show, as in the earlier stage, evidence of inflammation.

(4) Stage of Resolution Naked eye Appearances—The lung is still somewhat distended, but is now much softer From the cut surface considerable quantities of grey, milky fluid can be expressed

Mirratopia Afforances —The alveolar plug is contracted still more, and may be abreat along ther. The contents of the alveola are granular material and degenerated leucoytes. Multiplication in the endothelial cells of the alveola is often seen, as evidenced by their greatly increased number. These may be found surrounding the remains of the plog. The capillanes of the alveolar walls are again distended with blood.

Other terminations than resolution in the case of lobar pacumonia are (i) septic softening, which may go on to gangrene, (2) fibrosis, or overgrowth of the fibrous support ing tissue of the lung, producing chromicintersitual pneumonia.

In carrying out a cost mortem in a case of acute lobar

pneumonia, the following conditions, more especially, should be looked for in organs other than the lung —

- (1) A leucoblastic condition of the bone marrow associated with the marked polymorphonuclear leucocytosis of the blood in the disease
 - (2) Acute congestion of the spleen
 - (3) Cloudy swelling of liver, kidneys, and heart muscle
- Other conditions which may complicate the disease are ulcerative endocarditis, pericarditis, meningitis, peritonitis

2 Lobular Pneumonia

Synonymous terms for this condition are (1) bronchopneumona, from the fact that areas of lung in connection with, and around bronchi are involved, (2) catarrial pneumonia, from the character of the exudate most characteristically found in the alveoli

The etology of the condition may be said to be the same as in the lobar form of pneumonia. It is more frequent in children, and is the form of inflammation of the lung found in the specific fevers. The matter might be put in this way, that pneumococcie infection of the lung in children usually shows the lobular type. When the lobular type occurs in adults, the causal germ is usually some other organism than the pneumococcie, e.g. streptococcie, sold-phococcie.

Nature 4 spearances — The lung may be slightly more distended than normal. It has a motified, red surface, with (1) dark purple depressed areas of collapse, (2) red, firm areas of consolidation, and (3) pale areas of compensatory emphysema. On handling it, rregularly scattered areas of a firmer consistence than the rest can be felt. On section, the same motified appearance is visible, with dark purple areas of collapse where a bronchus has become plugged, pink areas of consolidation, more or less rounded (Fig. 43), in the carter of which can often be seen a small bronchus, from

which, on squeezing the lung, a small bead of thick white secretion can be pressed, also paler emphysematious areas. The lung tissue generally is congested. On opening up the bronch, their mucous membrane is found sweller and congested, with more or less puriellat looking secretion. The bronchial glands are congested and sweller. The smaller bronch and broncholes within the lung substance are not infrequently dilated, sometimes to such an extent that a "honeyromb" appearance is produced (see Proncholectains)

Microscopic Affectuance. —To realise the true nature of the change, large sections of long should be cut. The crossibilation will then be seen to be patchy in its distribution, the plugged already being usually situated round a small bronchius or bronchoole as their centre. This bronchos shows the appearance of acute bronchists, and its wall is infiltrated with infiltratively cells. The elastic cost may be reputated, and not infrequently the lumen is diated. The already area of contain plugs which may be more fibrinous or more feucocytic, the appearances varing considerably in different types of the darea more of the cells filling the already are of the catarnhity, i.e. they are cast off, swellen endothelial cells. Hence the term "catarnhit pneumonia." The walls of the alveoli queerally show congestion of their vessels.

Broncho-pneumonia may resolve or may pass into septic pneumonia or gangrene The associated changes in spleen, bone marrow, etc., are the same as in lobar pneumonia.

3 Purulent or Septic Broncho-Pneumonia

This condition may occur -

 As a sequel to broncho-pneumonia, especially when of the so-called aspiration type, e.g. associated with the inhala tion of scotic material, as after operations on the mouth

- (2) Associated with obstruction to the bronchs, as by tumour or aneurysm leading to retention of secretion (so called "retention" pneumonia)
- (3) Associated with the presence of a foreign body in the brouchs.

(4) As a blood infection due to the deposition of organisms or infective thrombin in the pulmonary vessels (embolic or metastatic pretumona), found specially in such conditions as osteomyelitis and pyzima Septic infections are not inferquently associated. Such infarets have the same distribution and often very much the same appearance as the non septic type (see p. 157), but they tend to be paler and often show softening in their centre. Under the microscope such infarets are characterised by immense numbers of polymorphonuclear leucocytes in addition to red blood cells, also by masses of organisms.

In all the above the appearances are the same as in broncho-pneumonia, but the inflammatory changes are more acute, and there is a greater tendency to destruction of pul monary tissue. The bronchi are filled with purulent material

Abscess —A true lung abscess, defined as a suppurative inflammation involving the lung substance, is comparatively rare. It arises either as a suppurative softening of a pinel monia, lobar or lobular, or as a blood infection due to the lodgment of an infective embolus. Such abscesses are commonly small. They are surrounded by a zone of consolidated lung and show ragged irregular walls. They usually pass on into gangrene. In addition to the above there may be included under the term, cavities which form in relation to foreign bodies impacted in a bronchus, also localised empyemas rupturing into the lung. Bronchicectute and tuberculous cavities are in a sense abscesses, but they are not usually classified as such

Gangrene — This is usually a secondary condition, the result of putrefactive organisms reaching a consolidated or necrosed portion of lung. This it may follow bober or step pneumonia, infarction or abscess. It may also be due to direct extension, as from a ruptured ulcer of the asophagus, or from a subphrence abscess. It may be due to the presence of foreign bodies in the bronch, such as come or false teeth

The area involved is at first intensely congested, later it

becomes black, and the lung substance breaks down and comes away, leaving a cavity (Fig. 46) lined with black or greenish black walls, the colour being due to changes in the effused blood. The contents of these cavities and of the bronch are usually brown, like prime juice, but may be paler, like pus or putty. The neighbouring portions of lung show postumonic consolidation. The Godour is always most offensive.

4 Hypostatic Phenmonia

This is a type of pneumonia associated with hypostatic congestion and orderna of the lungs, and therefore found in the posterior and lower portions. It is the type of inflammation which supervenes in old age, and in waiting diseases generally

The distribution of the change allows of immediate recognition. The consolidation is usually partial and associated with ordema.

Microscopically the appearances differ in different parts—congestion, orderna with catarrhal, fibrinous, and leucocytic consolidation, all being found in close contact.

5 Interstitial Preumonias

These are conditions in which there is increase in the fibrous tissue of the lung. They may be divided into three groups.—

- (1) Those following free your acute freumonia
- (2) Those due to the inhalation of dust of various kinds
- (3) Those due to chromically acting bacterial poisons, tuber culosis, sypbilis, actinomivosis

Irteritial Pneumonia following acute tobar or bobilar pneumonia is a comparatively rare condition. It usually shows itself as localised areas of thickening of pleura and interlobular septa also of the forous ussue at the root of the organ. Sometimes it is more diffuse, involving considerable areas of lung tissue. In this condition, as in other types where there is marked thickening of the alreadar walls, the endothelial cells of the alveolar walls, the endothelial cells of the alveolar walls.

Interstitial Pneumonia due to the Inhalation of Dust

(Pneumokoniosis) —There are three common varieties of this, according to the type of dust inhaled —

(1) Anthracosis or coalminer's lung

(2) Silicosis or stonemason's lung, also known as Chalicosis

(3) Siderosis or needle-grinder's lung

In all these conditions the foreign particles which are inhaled are absorbed into the lumphatics, partly by the action of phagocytes They tend to be deposited along the course of the lymphatics, and there to set un irritation and consequent fibrosis. Thus nodules of fibrous tissue develon beneath the pleura, along the interlobular senta, brought and ressels. The fumph plands at the root of the lung are enlarged and indurated Owner to the irritant action of the foreign particles preparing the way for germs, tuberculosis is a very common accompaniment of all these conditions They are also frequently complicated by chronic bronchitis and emphysema, and by a degree of catarrhal pneumonia, and occasionally by bronchiectasis. The siliceous partieles are more irritating than the carbon, hence the nodules of fibrous tissue tend to be larger in silicosis than in anthracosis . there are also more catarrhal changes in the alveoli. The steel particles are more uritating than the siliceous, hence the changes are most marked of all in siderous

Anthracosis —There is always a certain amount of pigmentation in the lung of town dwellers and also in most country dwellers. This is enormously accentuated in those who work in coal mines. When well marked the condition is known as anthracosis. The lung is usually black, or almost black, with small, hard, black pouldes scattered under the pleura and in the lung substance (Fig. 48). On squeezing, there exudes an inky black fluid. The bronchal glands are enlarged, deeply pigmented, and indurated.

Microscopic Appearances - The nodules are found to consist of well formed fibrous tissue mixed with carbon

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p gment. They occur under the pleura, along the interlobular septa, bronchi, and vessels. The superficial layer of the pleura is, however, free from p gment. There is some degree of catarrhal change in bronchi and alveoli, and some thickening of the vessels.

Sillcoux.—The lungs in this condition are grey in appearance, and, scattered through them, are numerous grey nodules, which are hard and gritty to the touch. Similar nodules are present in large numbers under the visceral pleura. They tend to be larger than those in anthracesis (Fig. 47)

The disease is not unlike the more chronic forms of tuberculosis, and, as alread; pointed out, it is not infrequently complicated by it. The pure condition may be distinguished from tuberculosis by the hard and gritty character of the nodules and by the absence of cavitation.

Micros opic Appearances — These are the same as in anthracous but the pigment is not so obvious (all-outh carbon pigments is also present) and there is more estatrial change in the surrounding lung. There may be endurients obliterans of the versule. Tuberrulous is often suremided.

Siderosis.—The nodules in this type are larger, owing to the greater irritation of the metal particles. The lungs have a grey appearance and may be almost solid. Evidence of tuberculous disease is very frequently present in addition.

Microscopically, in addition to the larger areas of fibrosis, there is more catarrhal change in the alveoli, between the nodules of fibrous tissue

Syphilitic Disease (a) White Pneumonia—This is a condition occasionally found in children suffering from congenital syphilis. The lungs are pale and firmer than normal.

Mayreacepted y, there is found an overgrowth of fibrous tissue involving the walls of the irduseful alreol. The endothelium lining the alreoli is cubical instead of being faitened.

- (b) Gummata—These occur as small caseous foci surrounded by fibrous tissue They are not infrequently absorbed, leaving puckered cicatrices behind. They are indistinguishable from tuberculous caseous masses.
- (c) Interstitual Pneumonia in acquired syphilis occurs as area under the pleura or towards the root of the lung. There is thickening of the pleura, of the interlobular septa, and increase of fibrous tissue around the bronchi and vessels. The last usually show endarterits obliteration.

Microscopically, there is overgrowth of fibrous tissue, usually catarrh of the alveolt and often accumulations of small round cells (miliary gummata)

TUBERCULOSIS

Tuberculosis -The lungs are by far the commonest site for tuberculous disease. In a large proportion of cases the disease does not progress far and soon heals, leaving merely some cicatricial tissue behind The apex of the lung is the seat of election for the disease. Very often the apices of both the upper and lower lobes are affected The disease may reach the lung by any of four paths (1) the air passages, (2) the blood tessels, (3) the lymphatic vessels, or (4) by direct extension. In most cases it is im possible to say by what avenue the disease originally came Nevertheless, certain statements can be made regarding this question of the path of entrance (r) Where the tubercle lesions are uniformly scattered through the organ, the disease has been brought by the blood stream, and search should be made for some older focus of infection in some other part of the body or in the lung itself. This focus is cummonly a lymph gland which has become adherent to, and eventually has ruptured into, a vem or a large lymphatic trunk, such as the thoracic duct. Not infrequently the source is a focus in the lung itself which has invaded a branch of the pulmonary

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Characters of the Lenons—The tuberculous lesions tend to occur in the form of nodated foc. These may be widely separated from one another, or so closely packed that they are practically continuous. They are either grey and more or less translucent when they are formed of cellular elements and fibrous tissue, or opaque white or yellow when these clements have undergone cascation. There is always a certain amount of interstitual change or fibrous tissue forma tion, both in the lesions and in the lung around

In the more acute cases this fibrous tissue formation is minimal. In such cases the condition tends to spread diffusely, involving more or less of long substainer and producing a catarrhal consolidation of the alse oil which sucsequently undergoes a caseous change (caseous pneuronus)

Attentospically, the tuberculous teston is characterised by a cell aggregation, the individual cell elements showing three types (1) large multimudested or guant cells, the nuclei of which are arranged commonly in a cuted, or part of a circle, round a central clear, necrotic area, (2) spindle-shaped and branched cells, with nuclei resembling those of the guant cell, and, arranged round that cell (epithelio die rendottelio declls), (3) Jymphocytelike cells, with small dark staining nuclei and little protoplass.

In hypothesis the second search in represent cases, relatively fee in number. The grant cell is not infrequently abrent, and its place occupied by an area where the cells are breaking down. This area, as it enlarges loses all appearance of structure. It is the commencement of the caseous process. In addition, there is always more or less overgrowth of fibrous issue. In the rione acute cases caseation predominates, in the rione chronic, fibrous tissue formation. Where this inflammation process strades the abreoth there is consolidation of the lung, a coased dation characterized by the presence of some exodate, not as a rule fibrinous, with numerous catarbal cells and leuxocytes. This consolidation do ling also tends to undergo the caseous alteration whereby it becomes apparently structureless, but in this caseous focus the fibrous parently structureless, but in this caseous focus the fibrous

tissues, and more especially the elastic fibres, persist for long almost unchanged.

The clastic fibres of the long undergo some destruction both by fragmentation and solution, in the area where cells and nuclei are breaking down. The fibres which escape this primary destruction may persist in the caseous area for an almost indefinite period. It is largely for this reason that necrotic caseous areas of long remain firm. When secondary infection with progenic and other forms of microbes occurs, complete destruction of the clastic fibres and softening of the caseous area takes place, the softened material is coughed up, and a cavity results. Another way in which cavity formation on infrequently starts is by inflammation of the walls of a bronchus or bronchole. The wall, weakened by the inflam matory process, next gives way under the inecessed pressure associated with coughing. Destructive changes then occur, and a cavity results which subsequently extends.

Classification of Tuberculous Affections of the Lunes -The most satisfactory classification would probably be upon the basis of the path of infection, but, owing to the fact that in most instances it is practically impossible to be certain of the path of entrance of the disease, owing, further, to the fact that even in a case of probable aur-passage infection the disease may spread by the lymphatics, and even by the blood-vessels, this method is not entirely satisfactory. Another method of classification is on the basis of the main underlying histological change. As we have seen, there are essentially two such changes in pulmonary tuberculosis: (1) a filling up of the alveoli with exudate and cells (mainly catarrhal), in other words, pneumonia or inflammatory consolidation The consolidated area subsequently undergoes a necrotic (caseous) change. This type of lesion is characteristic of the more acute conditions, ie where the virulence of the organism is high or the resistance of the inthis bush frow, (2) A laying bown of new horous tissue usually in relation to pre-existing fibrous tissue (interalveolar, interlobular, etc.), 1 e fibrosis, or interstitual pneumonia. This

occurs in cases where the organism possesses a relatively low degree of virulence or where the soil (x) the individual) is unusually resistant. The two changes are commonly found side by side, but sometimes the one predormates, sometimes the other

Probably no method of classification is completely satisfactory, but the following has for long been found useful by the author. It has the advantage of describing in general terms the appearance of the lung condition as a whole. It may be regarded as a compromise between the two methods mentioned above

- x Miliary or Disseminated Meastatic Tuberculosis (as suggested by Orth)
- 2 Caseeus or Tuberculasu Broncho-Pneumonia, or, il diffuse, Caseous or Tuberculasu Pneumonia. This condition may or may not be accompanied by cavity formation. This includes the conditions which are usually described as acute bithuss.
- 3. Fibro-caseous Tuberculous, again either with or without cavitation. This includes the condition known as chronic phthisis.

There are objections to the above method of classification, but on the whole it will be found that most types of pulmonary tuberculosis can in this way be satisfactorily described

The riethod avoids the use of the term 'phthasis," which is really a clinical one, and not infrequently incorrect at this, meaning, as it does, a wasting disease. The terria used mertly form a starting ground from which to detail the more minute changes.

I. Miliary Tuberculosis or Disseminated Metastatic Tuberculosis

This condition is usually Rood spread, but may be spread by the lymphates It is associated with an older tuberculous focus in the lung, bronchial glands, or a lesson in some other part of the body. This primary focus should be sought for. Where the condition is blood-spread, tubercles will be found scattered through other organs and tissues, if not large enough to be seen by the naked eye, they will be found on microscopic examination

Naked-se Appearance—The lung is uniformly congested Scattered through its substance are immense numbers of grey, white, or yellow foot (Fig. 49), which may vary in size from something just visible to an area one or two millimetres in diameter. Frequently the areas vary in size in different parts of the lung. Sometimes they are found to be larger in the upper portions of the lung. Sometimes the areas are arranged in groups (staphyloid arrangement) round blood vessels or bronchi, indicating that the spread has been by way of the lymphatics. Where the distribution is uniform throughout, spread by the blood stream is most probable.

Microtopic Apparance — Scattered through the lung substance hetween individual alveols around bronch and blood vessels and interlobular septs, are rounded areas of cell accumulation. The cells composing these are chiefly monomiclear, of the epithelioid and lymphocyte type with catarrhal cells and a few polymorphs. Sometimes in the centre there are gaint cells, at other times the centre is occupied by an area where the cells and their muche are hreaking down. Not in frequently there is a distinct studenceles caceous centre. In specimens stained for classic fibres there will be found some destruction of these in the central area fitch plave heem included. In other cases (the more chronic type) the fibres are merely posshed aside by the aggregating cells.

There is always a certain amount of involvement of the surrounding lung alveoh. Those alveoh in the immediate neighbourhood are consolidated with exudate custorial cells, and leucocytes. As this area of alveolar involvement enlarges, the condution tends to pass into the second type—caseous broncho pneumonia. There is musully more or less new formation of fibrous issue m and around the nodules. In the

more acre type with necrotic centre this is minimal. In suitably standed percents undered baseling although few in number, will be found, more part cularly in the acute type, both infrequently benche and wessels will be seen in course of invasion by the nodules. It is the secondary invasion of versels with higgly accounts for the great number of the tuberdee, and for their varia son in sure, due to the fact that they are of different ages.

2 Caseons or Tuberculous Eroncho-Pneumonia or Caseons Pneumonia

Two types of this condition can be distinguished -

(1) A type in which there are erral of consolidation scalered through the lung, spread by the blood or by the lymphatics. This type is merely an example of the previous condution where there has been fairly extensive spread into the surrounding lung, so that a considerable group of alveols have become consolidated and have then undergone the caseous change (Fig. 50). This type is found practically exclusively in children. The individual areas may fuse with one another, so that the consolidation may be complete, un olving a whole lobe. Occasionally eaving formation may be found.

(e) A type which commence in one continuous printed by the large, usually near the apex of the upper fobe, and spreads from that point. In such a case the infection is generally believed to have been by way of the air passages. This type is the corinous one found in progressive acute tuberculous in the adult. It is only occasionally seen in the early stages, owing to the fact that it does not prove fatal until well advanced. Sometimes, however, the until stages are met with in cases dying of diabetes or other wasting disease. Usually, as the condition is met with in the post morter room, the area of consolidation is extensive and cavitation present (Fig. 5). Sometimes a less advanced type of the disease is found in one lang when in the other a more advanced stages exists.

Naked eye Appearances -The lung shows chronic, occasionally acute, pleurssy on the surface It is partially consolidated. usually the area of consolidation being towards the abex The cut surface shows areas of a white or slightly yellow, opaque appearance, not unlike grey hepatisation. These may be isolated and scattered, but there is usually one considerable area which may involve the greater part of a lobe. In these areas are cavities, usually small and often numerous, with ragged walls In advance of these areas, and often widely scattered through the lung, are grey or yellow tubercles in groups, indicating lymphatic spread (Fig 51) Besides spread by the lymphatics, spread by the bronchi (aspiration) and by direct continuity of tissue is observed in this condition. The bronchs show evidence of acute bronchsts and the lymph glands at the root of the lung are enlarged and show grey tubercles and caseous focs. There is usually more or less fibrosis in connection with this type. As the fibrosis predominates, it passes into the next type

This type of the disease has to be differentiated from acute lobar and lobular pneumonia and gangrene of the lung, also from growths of the lung The main points to remember in making this distinction are 1 Position—tuberculous lesions commonly apical 2 Extent—tuberculous lesions as a rule involving only a portion of a lobe 3 Surrounding parts—the presence in the case of tuberculouss of foor of lymph spread disease in the neighbouring portions of lung 4 Cavites—characteristic of tuberculosis, present also in gangeries, but in the latter the cavities possessing soft frable black-coloured margins and the other appearances character istic of tuberculosis (e.g. lymphatic spread nodules) being absent.

Asserting the discrete Appearances—The two essential processes going on are (1) a catarrial consolidation of the fung alseon which undergoes a caseous change, (2) lymphatic spread of the disease, with formation of caseating tubercles along the lines

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of the lymphatics These tend to spread into surgounding alreed and bronch, and so to mutate fresh areas of cascour pneumonia. The clastic tissue of the lung undergoest certain amount of destruction, but in the cascous areas the network is preserved and tends to persist until cavitation occurs. There is usually a certain oamount of mercase of fibrows tissue as evidenced by thickeoing of interalveolar walls, interlobular septia, etc.

Cavities may arise (1) in d lated bronchi or bronchioles, (2) as the result of infection of a caseous area with pyegenic organisms, and so the softening of the area (3) as the result

of the bursting of a caseous area into a bronchus.

The cauties are fined with breaking-down, caseous lung tissue. Su tably stained preparations will demonstrate tuberele bacilli often in very large numbers, bo in a catarrhal pneumonic areas and in caseous foci or walls of cavites

The vessels are often involved in the process, and blood infection by invasion of a caseous focus into a vessel is not infrequent.

5 Fibro-caseons Tuberculosis

This is the common condition found in cases of chronic pulmonary tuberculosis. It passes, on the one hand, by insensible gradiations into the previous more acute type of the disease. On the other hand, with increase in the fibrous tissue element, it passes into so-called "fibroid phthius". The term is one which is perhaps not the best possible, but it is descriptive, and is preferable to the purely clinical one of chronic "bothius".

The condition is usually complicated by caritation Hence in speaking of this type one would refer to it as fibro-

easeous tuberculosis with cavitation.

Naked-sye Appearances—The lung aboves on its surface evidence of chrome plearing. It is usually fronly adherent to the chest wall. For its removal it is advauble to strip the parietal plears from the ribs in the way described on p. it. The organ is distended, and on pulpation it will be found partially consolidated Usually this consolidation is more marked towards the upper part

On cutting into the lung the increase in consistence will be noted. The section will show the following appearances (Fig. 53). Towards the apex of the upper lobe will usually be found one or more cavities, one of which commonly is distinctly larger than the other, varying in size from a walnut to a tangerine orange. Indeed, in some cases the cavity may be found to occupy the whole of the upper lobe. The walls of the early are formed of thems tissue and are often comparatively smooth. Frequently bronchi and vessels of considerable size can be seen crossing the cavity, the lung tissue having largely disappeared from around these more resistant structures. Occasionally aneutysins may be found on the course of such vessels (Fig. 54).

Throughout the remainder of the lung there is a general interests on the amount of fibrous tissue. From the thickened pleura, thickened interlobular septa can be seen passing in The vessels and bronch are thickened. This thickening is usually more marked towards the root of the lung. The bronchs are not infrequently dilated their walls being pulled upon by the contracting tissue around. They show evidence of acute bronchits and contain more or less muce-purulent secretion.

The bronchial glands at the root of the lung are enlarged and show caseous or calcareous change

Around the cavity, or cavities, the lung substance is largely consolidated by a fibro-caseous process On analysis it will be found to consist of firm nodules, larger and smaller, which are pigmented and show caseous change

In advance of this more completely consolidated area, re in the lower part of the upper lobe and in the lower lobes, will be found isolated area of consolidation of a similar type, having a italphyloid arrangement indicating lymphatic spread In addition, there are officer areas of casous frommenta,

indicating recent acute spread of the disease — The presence of the latter areas suggests "aspiration" spread.

As a rule, in such chronic cases both lungs are affected.

As a rule, in such chronic cases both lungs are affectione, usually the right, showing the more advanced lesions

Contraction of the fibrous tissue in the various parts of the lung tends to occur, pulling upon bronch and air vesicles Dilation is thus caused, producing bronchiectais or emphysema (traction emphysema), as the case may be

The above appearances are found mainly in tuberculosis of adults, but similar changes are occasionally met with in children

This type of the disease requires to be distinguished from the other interstitial pneumonias, more especially from syphilitic disease and from sideosis. Aguin, the distribution of the disease—apreal in the case of tuberculosis, at the root of the lung or under the pleura in the case of syphils—is the chief means of differentiation. The presence of cavities is characteristic only of tuberculosis, although it should be remembered that silicous may be accompanied by tuberculosis. Lastly, the nodules in silicous are much harder and have a characteristic entity feel

Microsophie Affronance — One of the most atriking changes is the increase of fifteen inswer-shadening of pleura, of inter-lobular signs, thickening round essels and bronch. The fibrous tissue in these structures often above a market new development of elastic tissue fibres. The lung substance itself shows irregular consolidation due to the presence of numerous fibro-caseous areas some of which are nodules of tuberculous granulation tissue displacing the lung tissue. Others represent areas of caseous preumona, in which the elastic tissue network in suitably stanted speciment is still in the part of the present areas of caseous preumona, in which the elastic tissue network in suitably stanted speciment is still in the part of the present prediction of the present prediction of the present prediction of the present prediction of the predint of the prediction of the prediction of the prediction of the p

old The bronch show evidence of catarhal inflammation, as also the remaining lung threoli. The liming cells of the alreoli are office cubical instead of being flat. The cavities are lined with a zone of granulation tissue or of well formed fibrous instair. The vessels in the neighbourhood become partially or completely occluded by the occurrence of endartenis obliterians. In suitably stained specimens, tuberele bacilli may be found, but they are commonly very few and scattered. They occur chefly in the walls of the cavities and in areas of cascous incummata.

Pulmonary Complications in Tuberculoists—Rupture of a carriy into the pleura is not as common as might be expected owing to the adhesions which form, and which tend to obliterate the sac. It occurs chiefly in the more acute cases It may by resting the lung permit of fibrosis and healing of the lesion provided infection of the sac does not occur, but in most instances a pyopneumothoriax results.

Hamorrhage from the lung (hemophysis) is met with both at an early and a late stage of the disease. In the early stage it is seldom serious, as it is due merely to erosion of a small vessel in the wall of a bronchus. In the late stage, when large cavities have developed, it is much more serious, as vessels of considerable size may be exposed in cavity walls. Sometimes the actual rupture is preceded by a bulging or aneutrysm formation.

Thrombors: in the larger vessels sometimes occurs, but it is chiefly a terminal phenomenon. A thrombus formed in this way in a pulmonary vein may be carried into the systemic circulation and cause embolism in a splenic, kidney, or other terminal vess?

Endarterits obliterans has already been mentioned as a constant occurrence, one which has a great influence in pretenting the more severe forms of hæmorrhage in chronic cases All degrees are met with, from narrowing of the lumen

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to complete closure The endothelal lining of the smaller vessels and capillaries is early noblished in the tuberculous process, forming one source for the epithelinoid cell of the foliacle. This mobilisation leads to obliteration. Hence the avascularly of the tubercle nodule

Chronic pleases is always met with in chronic tuber culosis. It leads, in a reajonity of instances, to the formation of albeatons and sometimes to obliteration of the pleased Security it is of a fibrous type but an organising fibrinous exudate is not uncommon in acute cases.

exudate is not uncommon in acute cases. Section of the lung substance has been mentioned as a characteristic feature of the more chronic forms of pulmonary tuberculous rather than a complication. The contracting hands of fibrous tissue reduce the size of the lung, diminishing the area of resonance and through adhesions pailing the diaphragin upwards and the mediastinal ussue with the heart in one or other direction. The same process tears open the bronchi and the air spaces, producing bronchiectains and traction emphysema. In a large proportion of cases the disease, starting in the apex, progresses only for a short time, ultimately healing and leaving a fibrous sear and a thickned pleura most often with adhesions to the done of the pleural sec. Occasionally an old healed lesion lights up in later life and spreads rapidly. Thus there may be found together lesions of the oldest and the most recent type.

Acute pneuronias of a pneumococcic or streptococcic origin frequently terminate tuberculous cases, and acute infections of the pleura occasionally occur, as a rule through rupture of a cavity

Tuberculous sufection of the mediantinal and browshing lands constantly occurs. Such glands may show grey inflitration, caseation, or calification. They may rupture into seesify and produce a generalised infection. Occasionally a calcarrous mass produced in this way ulterates into a bronchius and rusy cause harronthage. Not infrequently, especially in

children, the disease takes origin in the lymph nodes, subsequently spreading into the lung substances by the lymph channels

Changes in other Organs in Cases of Pulmonary Tuber culasis—In cases of milary tuberculosis, metastatic foci are found in liver, spleen, and kidneys as in the lung Acute degenerative changes, such as cloudy swelling and early fatty change, will be seen in the parenchymatous organs, also acute congestion of the spleen. In carrying out postmertem examinations upon cases of miliary tuberculosis careful search should be made for the site of invasion of the vessel. Attention should be specially directed to the condition of the thoracie duct and the retropertional lymph glands. The various branches of the pulmonary artery within the lung should also be slit up

In the more usual form of caseous pneumonia or fibrocaseous tuberculosis, cloudy swelling and fatty change in such organs as heart, liver, and kidneys is constantly present Not infrequently the liver is greatly enlarged from an extreme degree of fatty infiltration. Waxy disease also should be sought in spleen, liver, kidneys, etc. Very often acute metastatic spread of the disease occurs terminally in these cases also, with the presence of miliary foci in all the internal organs Intestinal tuberculosis-ulceration of bowel and caseous mesenteric glands-is not uncommon as a secondary manifestation due to the swallowing of infected sputum the more chronic forms of pulmonary tuberculosis the right side of the heart will be found hypertrophied and dilated, and, as a sequel, chronic venous congestion of liver, spleen, etc. Tuberculous meningitis due to spread of the disease to brain or cord is a common termination of the more rapidly progressive cases

Careful investigation should always be made of the various groups of lymphatic glands—cervical, bronchial, mesenteric—

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with a view to deciding the point of one in of the disease The condition of the bones and joints should also be looked into Finally, in investigating cases of tuberculosis where there are many lesions present, with a view to determining

the site of origin of the disease fin other words, the oldest lesion), the following points should be attended to (1) hature of lesion-caseous for are always older than crev. cellular foci, calcareous foci are older than caseous Fibrosis is also indicative of long standing disease (2)

Extent of lesion-other things being equal, an extensive lesion is older than a small one Tumours of the Lung -Simple growths of the long are very rare. Malignant growths are comparatively common more

especially sarcomata, but primary growths of a malignant nature are rare. Straining as they do the whole of the senous blood of the body which has not been strained in the capillaries of the liver, the lungs are not to be the seat of deposit of

metastatic growths which invade the veins. Thus secondary growths are common Sarcomata are much more frequent in the lungs than carcinomata. The latter occur but in appear ance they are almost indistinguishable from the sarcomata Another common type of growth in the lung is a sarcoma arising in the clands of the mediastinum and spreading into the lung substance by d rect extension (Fig. 56) Occasionally the growth starts in the pleural surface, and either remains limited to it or penetrates the lung Naked eye Appearances - The growth may occur in the form of white or grev isolated nodules (Fig. 55), or there may be large areas of lung infiltrated with growth. In both instances the condition is not very easily distinguished from grey hengtisation or tuberculosis, especially as necrosis is

common and spread along the lymphatics of vessels and bronchi can be seen In the case of growth, however, the infiltrated areas have a more translucent appearance, due to the fact that they are formed of cellular tissue. Another point of distinction is that cavitation is not observed in growths. Also it should be remembered that the seat of election in tuberculosis is the apex. There is no particular portion of the lung specially liable to be affected by growth unless it be the root,

DISEASES OF THE PLEURA

Hydrothorax or Dropsy of the Plental Cavity—A ship temout of free fluid is a common finding at a post mortem. Where there is any large quantity, a careful note should be made of the appearance, distribution, and approximate amount of the fluid. It is usually pale, clear, and straw coloured, and has a specific gravity of 1009 1012. On microscopic examination of the centrifugalised deposit, a few endothelial cells and lymphocytes will be found. As a rule the fluid is situated at the most dependent portion of the pleural cavity, but accumulations may occur, limited by adhesions, at other parts. The condition of hydrothorax is found in cases of chronic heart and hidney disease, where, as a rule, there is dropsy of other parts.

Hematothorax, or blood in the pleural cavity, is a rare occurrence. Free blood is only found in connection with injuries to the lung or chest wall and in malignant disease Small extravasations of blood may be found under the visceral better in accute infections, in aniemies and in asphyxica.

Pneumothorax * e gas or ar in the pleural cavity This may be due to a wound of the chest wall or lung rupture of an acute tuberculous earity, of bealthy lung or emphysematous lung in a parox sim of coughing. It may also be due to the presence of gas-producing organisms in the pleura, these organisms coming usually from a ruptured escophageal or gastire ulcer, or spreading through the disphram from a fiver abscess or pentomits. In the last case a purulent in flammation of the cavity is present as well, the condition being known as prophenumchonax.

In all the above conditions, in the absence of adhesions which would bind the lung to the chest wall, complete collapse of the lung occurs

Acute Pleurisy—This condition may be primary, due to spread by blood or lymph, or secondary, due to extension from lung, pericardium, mediastinum, peritoreum, etc Three types of the condition may be distinguished—

- (1) Dry or formous, where there is little or no free fluid
- (2) Serous or sero-fibrirous where there is more or less free fluid, in which there are commonly flakes of fibrin floating
 - (3) Purulent, where there is purulent fluid

The last is usually known as emprema. Naked or Appearance:—The surface of the lung shows, over a larger or smaller ares, a rough promise or thick prague white or yellow deposit (Fig. 54). This may be adherent or enally removed according to the duration of the inflammatory process. The pleura underneath shows injection of its results and the subsecent lung may show pneumonic consolidation, or sorietimes abscess formation. If the fluid be large in amount and if there are no adhesions binding the lung the organ shows collispen.

In the case of empyemas which have been in existence for some time, there is usually considerable thickening of both parietal and vi ceral pleura (Fig. 41)

Misrot visc Affermants —The vessels of the Peura are distended with bood. There is a Obmona congulum on the surface, and also in the intertuce of the pleura, in the meshes of which are extangled feucocytes, chiefly of the polymorphometer variety in the east or stage. The endothelial cells of the penal surface may be swellen but at ill attached, or they may be through off and occur free amongsit the fibra. If the condition has lasted for some time, there is endence of organisation—young blood vessels badding out from the presents of ones of the pleura, and young connective issue cells as companying these mot the evaluta. These is the refibroblastical.

are at first rounded, and possess a relatively large amount of protoplasm Later they tend to hecome spindle shaped, and eventually to arrange themselves parallel to the pleural surface From their protoplasm, fibres are split off which form the intercellular fibres of the new tissue

Empyema.-Although the word is also applied to purulent conditions of the gall bladder and other closed spaces, the usual significance of the term empyema is a collection of pus in the pleural sac As regards content, there are all gradations between an ordinary pleurisy with clear serous fluid through sero purulent exudate to thick opaque pus. The condition may be generalised, se the inflammatory process may extend throughout the sac, or it may be limited by adhesions Occasionally the pus, limited in this way, collects between the diaphragm and the lung, or between two lobes of the lung or between the lung and the pericardial sac Such accumulations may discharge themselves by opening into the lung. In that case they may be classed as pulmonary abscesses The condition most frequently follows a nneumonia, and the commonest germ is the pneumococcus Another very common organism is a streptococcus, others occasionally met with are staphylococci, B pyosyaneus, and germs of intestinal origin. Sources of infection other than the lung are the blood in pyzema, a penetrating missile or instrument such as an exploring needle, a focus of suppura tion in the peritoneal cavity or liver, and an ulcerative condition of the ecophagus The pleura is usually thickened, in the chronic cases greatly so, and shows microscopically the appearances of an organising pleurisy Should the exudate remain unabsorbed or unevacuated, calcareous material may be deposited in it

Collapse of the ling to a greater or less extent is of course a constant occurrence in diffuse employment Re-expansion occurs subsequent to absorption or evacuation of the excudate unless the case be very chronic and the lung bound down by firm adhesion.

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If gas, either from the lung or from the presence of gas producing germs, occurs in the sac along with the exudate, the term pyopneumothorax is applied

Chronic Pleurisy—This is a very common condition, either in the form of adherous between long and chest wall, or as areas of thickened pleura without adhesons. It is a constant occurrence in subacute or chronic disease of the lung, such as tuberculosis. In this disease the pleura may be very greatly thickened, as much as one under in certain cases.

Missuspin Apparames —The thickened pleura consust of spudie-lapped connective issue cells arranged parallel in the surface with intervining susous collegenous fibres. Some times these latter are separated mere or less undely from one another owing to externa. Through this issue are scattered as few wandering (tymphospite les) cells. Rann ga at right argies to the surface of the original pleura are ressets which ware in use and thickness.

METHOD OF EXAMINING A LUNG REMOVED FROM THE BODY

Look in the first place at the shape of the organ. The rormal lung will become flattened on being placed upon a table, whereas the consolidated lung (whether the consolidation be due to fund or solid exudate in the alveoli) retains its rounded shape. Note the site of the organ. An organ the seat of emphysema is usually more voluminous than usual. Weigh the lung. The weight of the normal lung is about 1 lb 2 oz. to 1 lb. 12 of (\$18-764 grammes), the right being a little heaver than the left, and the lung of the male somewhat heavier than that of the female. Examine the surface of the organ for expdate, fbrows thicken or, small harmorrhages Note the amount of p gment present at the points where the interiolular septa to a the pleura. Exam re the margin for evidence of emphyseria and look for an- puckering of the surface, especially at the aper hert feel the organ carefully all over, searching specially for any hard areas which would indicate consolidation. Note the distribution of the firm areas, whether discrete or d fire Incise the organ longitud nally

(see n 20) and examine the cut surface as to colour Note the distribution of any congested areas. Feel the surface carefully and source the tissue between the fingers, noting if any fluid escapes and the character of such fluid. Any areas of consolidation should now receive more careful attention as regards colour, distribution, etc. It may be necessary further to incise firm nodules or areas and to remove portions in order to ascertain whether they sink or float in water. Where cavities are present their position, shape, character of contents, wall, and surroundings are all points to note. The large bronchi should then he opened and the character of their contents and appearances of their walls noted. The bronchial and mediastinal glands should be examined as to size, consistence. presence of grey or yellow tubercles etc. The branches of the pulmonary artery should be slit up and examined for unpacted thrombi.

CHAPTER VIII

DISEASES OF THE INTESTINAL TRACT AND PERITONEUM

Diseases of Month, Pharynx, etc. — The condition of the teth should always be unestigated. The presence of caries should be noted. More particularly in cases of severe anamin, suppuration should be looked for in the mouth carrier, Proprieta also claims is commonly associated with chronic toxxrus and anamis. In any case where enlarge ment of the certical gleads is present, the mouth and pharynx should be carefully investigated for tumour formation, suppurative foca, actinomycous, etc.

In desidering the tomis and pharynx should be examined.

for false membrane. It appears as grey opaque areas surrounded with congestion. The membrane in this position is is not easily removed, as it is formed of the covering epithelium infiltrated with fibrinous exidate. In any suspicious case not disgnosed during life, cultures on blood serum as well as films should be made.

Acute Pharyngitis.—Acute catarih of the pharynx is a constant accompanient of the common rold. It may spread upwards into the nose and its inuses or downwards into the larynx, traches, bonneds, and hang: A certain proportion of pneumorias start as nore throats. Another important extension is up the Estachian tube and into the middle ear, where an acute office middle ear, where an acute office middle ear, upware of the eard drun, possibly extension to

the mastoid antrum, and complications in lateral sinus and brain. Whether or not there is a specific germ for the condition is uncertain, but pneumococci and streptococci are the organisms which most often grow on culture, and they are usually present in the complications of the accessory sinuses and middle ear. Repeated attacks of catarrh are often associated with the abnormal development of lymphadenoid tissue in the renom—adenoids and enlayer tonsils.

Acute pharyngits is also a manifestation or complication of many of the specific feeers, notably of scarlet feeter, diph thena, and influenza. The throat is acutely congested and swollen, and there is a tendency for the accumulation of secretion, which in the case of diphthena forms what is known as a false membrane. Streptococci are almost constantly present in these infections either alone or accompanying other germs. There is a marked tendency for the infection to apread to the neighbouring lymph glands, and sometimes a spreading inflammation of the tissues of the neck (angina) results. In such a condition edema of the glottis may occur

Tonstilitis —Acute inflammation of the tonal is a constant accompaniment of acute pharyngitis or sore throat Repeated attacks of the condition lead to an enlargement which is more or less permanent, and which is a simple lymphoid hyperplasa (enlarged tonsil) Sometimes foot of suppuration develop and may remain unrecognised and form areas of absorption of bacteria and their products Streptococci are the common germs present. At other times a large abscess (quinsy) develops rapidly and may discharge of its own accord.

What is known as epidemic sore throat or glandular feer is an infection due to streptococcus hamolyticus, conveyed, it is most generally believed, from the cow's udder, by milk or mill products. There is marked cervical glandular in the control of the control o

Acute rheumatism is another condition almost certainly due to a streptococcus which very commonly starts in this situation. The organism enters the blood from the tonulis and shows a marked tendency to attack the joints and the endocardium, setting up an acute non supportative arthritis and vegetative endocarditus. There appears to be a group of allied organisms, all streptococci, which specially affect the tonsillar region and show the same affinity for joints and for the endocardium.

Diphtheria has been referred to as usually starting in this region, often on the tonish itself. It is characterised by the formation of a grey false membrane partly made of fibrinous extudite, partly of dead surface epithelium, and therefore difficult to remove Unlike some of the other affections of this region the germ does not commonly enter the lymph or blood stream although complicating germs such as streptococci may do so. On the other hand, the toxin of the organium is readily absorbed and shows a special affinity for nervous tissue.

A condition corumon on the tonsil and not infrequently mistaker for diphthena is Vlinean's augina. It is due to the presence of two germs—a piprochice and B furiformis. There is often a membrane present which in contrast to diphthena, is easily removable. Ulceration may occur in chomic cases.

Syphilis and tuberculosis both attack the tonsillar region In secondary syphilis, crythema and mucous patches occur, the latter sometimes simulating diphtheria and Vincent's angula

The totall is generally regarded as an important portal of entrance in tuberculous. The disease may pass through into the lymphatic system without producing any charge offer than simple enlargement. Thus a proportion of totall existed for enlargement are found to show on careful microscopic examination evidence of active tuherculosis. A certain percentage of these tuberculous infections are bovine in origin. The cervical glands become infected and the disease may spread from there to various parts of the body.

Diseases of the Esophagus — When any condition affecting the crosphagus is suspected, as in posoning, dys phagua, hæmatenesis, care should be taken to remove the viscus entire along with the pharynx and stomach. This can hest be done by removing tongue, pharynx, contents of chest and abdomen in one piece as described on p 24, and then removing the individual organs as required, opening the crosphagus from behind and examining it in continuity with the stomach

The esophagus is not infrequently the seat of various vents in earthous of the later. This is due to the fact that the ears from the lower part of the esophagus drain indirectly into the portal vein, which in carrhoss of the liver is obstructed. The esophagusal veins dilate and become variouse. Such veins may rupture, and severe, even fatal, harmorrhage result

The esophagus suffers along with the stomach in corroster poisoning, and presents much the same appearance as that organ (see p. 394). Rarely it may be the seat of pepine ulers in its lower part. Such an uler may rupture into one or other pleural cavity and cause a proponeumothorax.

Tumours of the ecsophagus are occasionally found, by far the most common being squamous epitheliomata. Very infrequently leio myomata are seen. The squamous epithelioma of the ecsophagus is found in the form of an ulcer with raised infiltrating margin. It tends to form a ring shaped area of construction, and is situated either high up about the level of the circond cartilage, low down near the cardiac orifice of the stomach, or at the level of the bifurcation of the trachea. (Fig. 53) The ulcer may extend deeply, perforating the trachea, bronch, one or other pleural cavity, or pericardial sac-

DISEASES OF THE STOMACH

Owing to the action of the digestive juices of the organities!, and owing to decomposition in its contents and in the contents of the neighbouring viscera, the stomach undergoes considerable changes after death, and the longer the section is delayed the greater will be those changes. Blood tends to accumulate in the vessels of the organ at its more dependent parts, giving the appearance of congestion, and even of hemorrhage. As the result of decomposition in this blood green discoloration takes place. Frequently there is softening of the wall owing to digestion by the gastine juice. This may occur to the extent of causing actual perforation. Devicually, therefore, care must be taken in interpreting changes found in the stomach fort morter. Changes such as softening when they occur before death tend to be diffuse in their distribution, whereas post morters softening is found mainly in the more dependent, and therefore posterior, part of the viscus.

Foreign bodies of various kinds may be found in the stomach, such as false teeth bundles of hair or thread, or undissolved medicinal tabloids in eases of suicide

Dilatation of the Stomach. — Gastrectasis. — Acute dilatation may be due to the ingestion of excessively large quantities of fold, or at may be nervous in origin sometimes following surgical operations

Chroric distation may be due to (t) narrowing of the pylorus from turrour, (z) the presence of abnormal contents from fermentation and atony of the muscular wall associated with chronic estarth.

Contractions of the Stomach.—Narrowing of the polonic ordine (congenial polonic structus) through thickening of the muscular roat is a somewhat rive condition Localized contraction of the organ may occur as a sequel to ulceration It tends to produce the condition of "hour glass" stomach

Ohronic Venous Gongestion.—In chronic valvular disease of the heart, chronic lung and liver disease, passive hyperemia tends to occur in the stomach as in other organs It is usually associated with the appearances of chronic catarrh, accompanied by congestion of the vessels of the nucous membrane. Minute himorrhages may occur, and these may be followed by small superficial ulcerations (homorrhage extensity).

Acute Catarrh of the Stomach may occur as the result of (x) dietetic errors, (2) the mgestion of irritant or corrosive poisons. (3) in the course of infective fevers

Naked eye Appearances—In slight cases there may be are swollen, the mucous membrane congested, and covered with strings of sticky mucus Small hemorrhages may occur Where the cause has been one of the corrosive poisons there may be necross and sloughing of the mucous membrane, sometimes with perforation In the case of certain poisons characteristic colouring may be present. For further information on the appearances of the stomach in cases of poisoning see pp 393.95

Microscopically the vessels of the wall are d lated. There is shedding of the superficial epithelium, and, in the more severe varieties necrosis. The wall is infiltrated with inflammatory cells and exudate from the vessels.

Acute Supparative Gastritis sometimes occurs in the course of specific fevers and pyzema or as the result of spread of inflammation from neighbouring parts. The portion of the wall affected is thickened pale yellow in colour, and found, on microscopic examination, to be infiltrated with fibrin and leucocytes. The mucous membrane superficial to the area shows acute catarrh, and sometimes exudate

Chronic Catarrh.—This may follow acute catarrh or develop independently. It is frequent in chronic alcoholics, and occurs in association with chronic venous congestion, peptic ulter, and carcinoma

The stomach is usually dilated. The mucous membrane is pale and atrophied. There may be scattered small himnor rhages or pigmented black areas following such. The surface of the mucous membrane is covered with thick stucky mucous screttion. Small followlar fucers may be present. These ulcers are shallow with undermined edges. They may heal, leaving a small pucketer does.

Microscopically beyond some overgrowth of fibrous tissue, catarrh of the gland cella, and infiltration of the coats with round cella, there is little to be seen.

Peptic, Perforating, or Chronic Uleer—This condition is found more frequently in females than in males. It is cheffly found in young, anemic girls between the ages of twenty and thirty. I may be associated with chronic pastine catarrh

thirty It may be associated with chronic gastric catarrh. The ulcer is commonly single, but occasionally there is more than one. It is sthunded usually on the posterior wall near the lesser curvature, and nearer the polorus than the cardia. About 1 per cent occur on the anterior wall. The ulcer varies in sr. Usually it is about the size of a sixpence, but it may be much larger. The magrain of the ulcer are rounded, smooth, and devoid of evidence of inflammation, presenting a punched-out appearance (Fig. 58). The floor may be formed by one of the coats of the stomach, but not infrequently it is formed of fibrous tissue, or of one or more of the organs behind the stomach, such as parcreas or liver.

Owng to the fact that the opening in the mucous membrane is larger, the opening in the muscular coat smaller, the ulcer may show a terraced appearance. The associated chronic inflammation in the wall of the viscus causes the formation of adhesions to structures lying posteror, hence with increase

of depth these organs become exposed in the floor of the ulcer. Not infrequently, however, before such adhesions can form perforation occurs. In the case of the ulcer on the posterior wall this will take place into the lesser sac of the pertoneum. The acute pentionius resulting is thus, at first, limited. In the case of the anterior ulcer, perforation occurs more rapidly, and takes place directly into the pentioneal cavity, causing a general pentionius. Hading may take place, associated with ocatination and sometimes the formation of an "hour glass" stomach. Besides perforation, another accident which may occur is hamoringe due to crossion of a vessel in the wall of the stomach, or possibly one of the larger vessels lying behind the organs.

A similar type of ulcer is sometimes found in the duodenum immediately beyond the pylorus. It resembles the peptur ulcer of the stomach in every respect except that it is more frequent in the male sex. As a rule the ulcer is small, but it may attain a large size (Fig. 59). As in the case of the stomach ulcer, the floor may be formed by fibrous tissue or by an organ such as the pancreas. Perforation and hamorrhage are accidents not infrequently met with in this case also

The causation of both types of ulcer is obscure Throm boss occurring in a vessel supplying the mucous membrane, with consequent maintainton and then digestion by the juxes within, has been suggested as an explanation of their occurrence.

Fibromatosis —Occasionally the stomach is the seat of a diffuse fibrous overgrowth implicating chiefly the submittoons and muscular coats and commonly associated with a chronicular. This condition, which is usually most marked at the pylonic end of the organ has been called fibromators. It is sometimes mistaken for maheraan the we growth

Tumours -- Simple tumours of the stomach are rare

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Tumours -Simple tumours of the stomach are rare

Fibronata, myomata, adenomata are described Mucous papillomata also occur

Of malignant tumours, sarcomata are uncommon,

Caranima—This is the common stomach tumour It is most frequently situated at the pylone end (66 per cent). The next most frequent site is the lesser curvature (20 per cent). About 10 per cent occur at the cardiac ordiac [Fig 60). As regards the type of cancer found, the most common is the encephaloid variety of the adeno-carenoma. The next most common is the terribox, then the colled, and least frequent is the squamous epithehoma, which is occasionally found at the cardiac end

The tumour may lead to a localised or diffuse thickening of the stomach wall. More frequently there is an ulcerated surface with a rused, hard, infiltrated margin. Sometimes the growth projects into the interior of the viscus as a cauli flower like mass (Fig. 60). The floor is formed of necrosed tumour substance. Perforation rarely occurs. Secondary deposits are very commonly found in the neighbouring glands and in the liver.

DISEASES OF THE INTESTINE

Post-Mortem Changes—These, as in the case of the stomach, tend to come on rapidly and are often very pronounced in cases when the autopsy is delayed or when the body is not kept under cool conditions. The coils of in testine become distended with gas. The gut wall assumes a dusky red colour from hiemoglobin staining. This is most marked in the more dependent coils. Softening of the mucous membrane and sometimes escape of blood occur. Digestion of the upper portion of the bowel may take place, but this does not as in the case of the stomach lead to actual rupture. If blood prigment is present either in the wall or

intestinal contents it rapidly assumes a black colouration owing to the formation of sulphide of iron

Maiformations.—Meckel's diverticulum is a finger like cuil de-sac, the remains of the omphalo mesenteric duct, usually 23 inches in length, occurring some 2 or 3 feet above the ileo-excal valve. It is sometimes attached to the numblicus. It may become closed and give rise to eyst or abscess formation, or it may become adherent to the parietes, thus forming a band under which a loop of bowel may become strangulated.

Smaller diverticula may be found in connection with other parts of the small intestine, such as the diodenium, and pouches between the layers of the mesentery may be found. Similar diverticula occur in the large intestine, and may when filled with inspissated feetal matter be mistaken clinically for tumours.

Dilatation of the bowel is found as the result of per tonits (paralytic distention), constipation, obstruction from strangulation, infarction or tumour fornation. When the obstruction is long-continued the wall of the bowel above shows bypertrophy (Fig 6)

A condition of dilatation of the large intestine, more especially the ascending colon, associated with hypertrophy of the muscular coat, known as Hirschsprung's disease, occasionally occurs it is believed to be congenital

Stenosis, or narrowing of the bowel, may be due to contraction associated with ulceration (especially tuberculous), tumour formation, or chronic peritoritis

Volvulus is a condition in which the bowel is obstructed by a loop of intestine becoming twisted upon itself. Half the cases occur in the pelvic colon. An abnormally long mesentery predisposes to its occurrence. The blood supply of the portion of gut is interfered with and gangrene tends to occur

Intussuception is a condution in which a portion of the bowd is invariganted into the section immediately below It occurs chiefly in infants, and is believed to be caused by violent peristaliss due to active purgation or diarrhosa. The condition may occur in the ileum or the colon, or at the ileo-czeal valive. The portion of bowel involved forms a sausage shaped tumour (Fig. 61). Pressure on the mesentery of the intussuscepted portion causes interference with its creditation and a tendency to camerane.

A similar condution easily reduced and often multiple, is not infrequently found post mortem. It is believed to develop very shortly before death. In this type there is, of course, no congestion of the intussuscepted portion, and there are no adhesions between the various layers of gut.

Hernia.—A hernia is usually defined as a condition in which there is a protrusion of any of the abdominal contents from the cavity of the abdomin. The term is also used in connection with the rare occurrence of a protrusion of gut through an opening such as the foramen of Winslow, within the abdomen.

As a rule it is either a fortion of boxel or a portion of omentum, or both, which protrudes Occasionally it may be a Meckel is diverticulum or an organ such as hier, spleen, or stomach. The sac of the herma is usually limed by peritoneum, afthough this may disappear.

The condition may be congenial, the sac being formed by a diverticulum of the peritoneum such as the processus vaginals. Vore usually it is acquired through increased abdominal pressure from coughing, crying, straining, or through weak ness of theabdominal wall, or from these two factors combined it may also be due to violence, such as a crush driving some of the abdominal contents through the dushragin

The protrusions are found at points of weakness in the abdominal wall, usually where vessels enter and leave. The commonest type is the inguinal kenna which occurs in the inguinal canal and may be congenital or acquired. The second commonest type is the femoral kenna, a projection through the femoral ring. In addition, there is an umbilical type found at the umbilicus which may be congenital or acquired. The latter type is found dietely in very fat women Certain rarer forms are occasionally met with, such as obstituted kenna, also hermize through the abdominal wall at points which have been weakened by scars following operations:

The condition is not of much importance to the morbid anatomist. Hermize are not infrequently met with by accident at a post mortem. Strangulation of the hermin, *e interference with the circulation of blood through the gut with consequent acute congestion and sometimes gangrene, is a cause of acute peritonitis but it is rarely seen post merriem. Internal bernize, *e** bernize through the diaphragim, are sometimes met with as the result of severe crushing of the abdomen.

Chronic Venous Congestion of the bowel is found in cirrhosis of the liver and in chronic heart and lung disease. There is swelling and congestion of the wall of the gut, especially of the mucous membrane. A degree of catarrhal inflammation is very constantly associated.

Infarction of a portion of bowel, most frequently of that part supplied by the superior mesentene artery, is sometimes found. It should be looked for in cases which die with symptoms of intestinal obstruction. The portion of gut moviled is deep purple in colour, and usually shows per tonits on its surface. The aorta and its branches should be slit up to find the point where the block occurred. Careful search should be made for a possible source of the embolus,

thrombus on an atheromatous patch of the aorta, or in the left side of the heart (see diag p 66) Acute ancury sms, sometimes as large as a pigeon s egg may form at the site of the embolism

Hæmorrhage occurs into the mucous membrane of the bowel in the form of small extravasations in cases of infective diseases, anæmias, etc

Large hamorrhages may occur from ulcerated surfaces, such as duodensl or typhod ulcers. The blood, maxed with facel matter, tends to undergo afteration into a black mass of putty like consistence which can be seen through the wall of the mut before it is sometime.

INFLAMMATION OF THE SMALL INTESTINE— ENTERITIS

Acute Catarrhal Enteritis may be caused by irritating foods, poisons, dust, by normal bacterial inhabitants of the bowel, such as B cols or streptococa, or by specific bacteria such as B to phosus and Vib cholera

Naked of Apparances—These are often unastisfactory. The clinical symptoms are frequently out of all proportion to the pathological findings. Usually there is some congestion of the vessels of the mucous membrane, which is more or less swollen. This congestion may be diffuse or pathy Often it is most marked at the apieces of the folds in the mucous membrane. When due to the action of a microorgamism the changes are commonly more marked in the lower part of the leuin. In cases of poisoning, on the other hand, the duodenium and upper part of the jejunum in addition to the stomach are the parts most affected, although it must be noted that irritant poisoning often causes this change (see p. 393). Not infrequently the lymph folicles of

the bowel are swollen (follucular enterits) and may ulccrate (follucular ulcers) The mucous membrane may be covered (follucular ulcers). The mucous membrane may be covered to the more than the more intense forms, the functions membrane may undergo necrosis, forming a greenish slough. Small embolic abscesses may be found in pyrama or there may be a general infiltration of the will of the gut with pus (suppurative enterits).

Microscopic Appearances —There is dilatation of the vessels of the bowel, infiltration of the wall with inflammatory cells and exudate, increase of the lymphoid elements and swelling of the endothelial cells in the solitary glands, catarrh of the superficial epithelium. In supportante entierits small abscesses and more intense inflammatory infiltration are found

SPECIAL FORMS OF ENTERITIS

r. Cholera.—The changes are most marked in the lower portion of the ileum There is intense swelling and congestion of the mucous membrane. The lymphoid follicles may be swellen and pale. Small harmorrhages may be present Membranous enterints may occur, due to the exudation of fibrin on the surface of the mucous membrane. The contents of the bowd are rule and watery frice water).

Microscopically, there is marked catarrh of the epithelum, possibly exidate on the mucous membrane, and infiltration of the wall of the bonel with inflammatory cells. The specific organisms do not penetrate the wall for any distance, but they are found in immense numbers along with desquamated epithelial cells in the rice water contents of the bowel. At a post mortem on a case of cholera, extreme rajor mortis is present. The blood is very dark and the muscles and tissues generally dry. Little that is characteristic is found in the internal organs. Small harmorrhages are sometimes seen in

the percardium and endocardium The mesenteric glands are commonly enlarged and show areas of necrosis. As in typhod the blee offers a special attraction to the causal germ. Thus cholera carriers may develop in the same way as typhod carriers.

2 Typhoid.-In this condition also the change is most marked in the lowest portion of the ileum It consists, in the early stage, in a swelling of the lymphoid tissue generally, both Peyer's patches and solitary follicles (Fig 62) These areas are pale, but the bowel between may show congestion At about the beginning of the second week of the disease. recrosis commences in these swollen accumulations of lymph old tissue (Fig 61) In this way slovens form which take on a yellow or green colour from bile staining. These slouelis separate towards the end of the third week of the disease and ulcers are left which have the following characters -The larger ones, representing as they do an ulcerated Peyer's patch, are usually in the longitudinal direction of the bowel, during the separation of the sloughs hamorrhage tends to occur The smaller ones, representing the solitary follicles, are rounded. The edges of the ulcers are ranged and over hanging The floor is formed of one of the coats of the bowel -the submucous, muscular, or pentoneal Perforation is not infrequent. The perstoneal aspect of the portion of bowel may show evidence of acute inflammation by injection of vessels and even fibrinous exudate

Occasionally, in cases dying from complications late in the disease, the ulcers may be found in process of cicatrisa tion

In a case of typhoid fever, in addition to the condition of the intestine, attention should be paid to (c) the measureric glands, which are constantly enlarged, congested, and may show harmorrhages and necrotic foct. (c) the spleen, which shows acute congestion, and, microscopically, areas of focal affecting stomach, small intestine, and large bowel, char acterised clinically by symptoms not unlike cholera, and showing congestion of the microsa, acute catarit, and cell in filtration (b) A type resembling ordinary typhoid clinically On the rare occasions when such cases come to autopsy, lesions of the small intestine, glands, and spleen may be found similar to those seen in typhoid. On the other hand, no characteristic lesion of the bowl may be present.

3 Tuberculosis — This is usually secondary to tuberculosis of the lungs, the intestine becoming infected by the swallowing of sputum containing tubercle bacilli. As a primary condition of the bowel, the discuss is comparatively rare, although it has been found in as large a proportion as ray per cent of all cases of tuberculosis.

Tuberculosis of the mucous membrane of the bowel is, however, by no means necessary found in cases where the intestine is the path of entrance of the tubercle bacillas. The disease may show itself first in the mesenterin glands or in the pertinenum, no demonstrable lesion of the bowel itself being present.

Nabel of a Appearances—The part commonly affected is, as in typhod, the lower portion of the alum. The earliest lesion consists in a tubercle nodule underneath the mucous membrane. Ulceration occurs over this, and tends, owing to the distribution of the lymphatics of the bowel, to spread laterally, often encircling the bowel, with the exception of that portion over the attachment of the mesentery. The appear ances in the fully developed ulcer are as follows: (Fig. 64) the direction is transverse to that of the bowel, although this character is by no means constant, the edge is irregular, nodular, but rounded, the foor is formed of tuberculous granulation tissue, the personnel appear shows opaque white thickening of the wall, the presence of tubercle nodules (Fig. 65) under the personneum, and sometimes white lines of 65) under the personneum, and sometimes white lines of

injected lymphaties radiating from the area Constriction of the bowel is common, as also is adhesion to surroundings.

Perforation is a comparatively rare occurrence in tuberculous ulceration, as also is harmorrhage.

The mesenteric glands are constantly enlarged and show caseous areas or grey granulations, occasionally calcification.

Microscopic Appearances —At the margins of the ulcer, in the perional coat, there are tubercle granulations with grant-cell or caseous centres Tubercle bacilli are not, as a rule, numerous

TUBERCULOSIS AND TYPHOID ULCERS CONTRASTED AS REGARDS THEIR NAKED BYE APPEARANCES

	Tabarcalous Ulcer	Typhoid Ulces
Direction	Typically transverse,	Typically longitudinal.
Margin .	Raised, rounded, nodular	Overhanging, ragged.
Floor	Irregular, formed of tuber culous granulation tissue	Smooth, formed of one of the coats of the bowel
Peritoneal aspect	Raised, grey or yellow tubercles. Thickening and sometimes construc- tion. Perforation rare Adhesions frequent	Evidence of scate inflam- mation, congestion, eru- date Perforation fre quent. No adhesions or constriction
Associated mesenteric glands	Enlarged and firm, caseous, Sometimes calcareous.	Enlarged, congested with necrotic foci, soft.
	ł	1

- 4. Syphilis.—This is a rare condition. It may occur in the form of guimmala, ulceration, or electrisation with stenosis.
- 5 Actinomycosis. This is also rare. It may affect the intestine or appendix. Secondary abscesses usually occur in the liver.

INFLAMMATION OF THE LARGE INTESTINE

In its slighter forms this condition is known as colitis, in its more severe forms as ulceratine colitis or dysenlery

As regards causation, (1) the slighter forms of the disease may be due to indiscretions of deet, chill, germs of various kinds. Of the more severe types, two varieties are distinguished. (2) Bastinal Dysintery, with which organisms closely related to D coli, e.g. Singas bacillus and Fleviner's bacillus, are more especially associated, (3) Treptial Dysintery, generally believed to be caused by a protozoon, the Entampola histolitica.

(t) The milder types of inflammation show congestion of the mucous membrane, some ordema, swelling of the lymphoid follicles, and, sometimes, slight superficial ulceration

Alteroscopically, beyond catarth of the mucous membrane, congestion of vessels, and infiltration of the coats with inflam matory cells, there is little to be seen

(a) Dicerative Colits or Bacterial Dysentery—The wall of the bowd is usually thickened. On opening the gut there is irregular idecration with tage of thickened mucous membrane between the ulcers (Fig. 66). These tags often occur in long tudinal ndges. The edges of the ulcers are overhanging, and the floor is usually formed by the submiscous or muscular cost. Occasionally, destruction of the muscular coat is found, and sometimes perforation.

Microscopic Apple transcs.—There is catarrh of the moccous coats. These are infiltrated with inflammatory cells and exudate, and there is marked swelling of the endothelial cells of the lymphatics and vessels.

The above description holds good more especially for the type of the disease found in Great Britain. In the type found in Japan, hamorrhages into the mucous membrane, purulent and fibrinous exudates on to the surface of the mucous membrane are described in addition to ulceration

(3) Tropical or Amebic Dysentery —Thewall of the howel is thickened, due largely to a thickening of the submucous cat, partly from fibrous change, partly from influence and partly from fibrous change, partly from influence influence in summerous small raised nodules the size of pin heads or small peas, most of which show a small opening in the mucous merintane through which a whitish slough can be seen (Fig. 67). The bowel between is congested. These mininte ulcers tend to run together, forming areas of more extensive ulceration. In the case of the larger ulcers the edges are overhanging and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is formed of submucous or muscular most and the floor is floor and the floor is floor and the floor is floor in the floor and the floor is floor and the floor and the floor is floor and the floor and the floor is floor and the floo

coat Rarely perforation of the bowel may occur
The seat of the more intense changes varies in different
cases Sometimes it is the caccum and ascending colon,
sometimes the transverse, sometimes the descending or
pelvic colon

The condition is very commonly associated with the tropical form of liver abscess

Microscopic Afgivarances — The wall of the bowel is a late interesting the submucous coat. It is also infiltrated with inflammatory exudate and cells. The nodules above mentioned are found to be flask shaped tuleers in the submucous coat, with overhanging margins and a small opening into the lumen of the bowel. The centire is occupied with a slowgh coasisting of necrosic tissue and leutocytes. Annebes are found in the slongh and in the submucous coat around They appear as large rounded cells with vacuolated protoplasm and a relatively small round nucleus. They can be seen in specimens stained with hierantan and cosin, but are better demonstrated by cosin, methylene blue (p. 424). In the areas of more extensive ulceration the elicers lose their characteristic appearance, and the changes are more like (nose found in the other type of dysentery.

Pstudomembranous or Duphtherstic Colists — This is a term anglined to a form of dysentery due to bacterial invasion, often by strepteococ, also to impession of mercurac chloride Occasionally it is seen as a terminal condition in nephritis Any part of the large bowel, sometimes the whole length, may be affected. The macous membrane is intensely congested and swollen and the superficial Jueys shows necessis. Patches of fibrinous exudate also occur. Thus a "false membrane" is formed which often appears black when examined after death. If the patient survives for some time the necrosed ususe sloughs away, leaving ulters which vary in size, shape, and depth.

Mucous Colitis —This is a condition in which tubular casts of the bowel or strings and masses of clear mucus are evacuated from time to time. The casts consist of inspissated mucus due to hypersecretion. The condition is frequently of nervous origin aggravated by growth of hickern and is accompanied by diditation of the large metatron.

Appendicitis -The appendix is a cul-de sac in continuity with the execum having the structure of the large bowel, with a large development of lymphoid tissue in its submucous coat, hence the name sometimes given to it of intestinal tonsil is subject to inflammatory changes spreading from the large bowel such as typhoid and the various forms of colitis, as well such as particles of metal and vegetable seeds, animal parasites such as Oxyuris sermicularis and facul matter may lodge in its lumen. Much of this material it is able to extrude by its muscular contractions Fæcal material is constantly entering and leaving it along with its own secretions Some times it remains for long periods and becomes inspissated and impacted In addition concretions tend to form which differ from inspissated faces in being rounded and consisting of underested particles of food glued together by mucus and having calcareous material deposited in them None of these foreign bodies play an important part in the causation of acute appendicitis They may obstruct and cause the accumulation

of secretion distal to their point of impaction. They may harbour germs and they may give rise to irregular contractions and thus to pain, but they do not cause appendictis

and thus to pain, but they do not cause appendicits
The actual cause of the condition is a germ—usually, in
the first instance, according to Aschoff, a diplo- or strepto
coccus. Whether this enters from some outside source or is
a normal inhabitant of the bowel with its virulence tem
porantly raised is doubtful. In the later stages, when the
inflammatory process is established, other germs such as
B coli, B proteux, B lactis aerogenes, various anaerobes and
other organisms are found. Occasionally B tuberculous and
Streptolius actionnyies occur as the main pathogenic agent

The primary lesion, in Aschoff's opinion, is to be found in a small epithelial defect in one of the bays or indentations of the mucous membrane. Sometimes the infective agent arrives by the blood stream, the germs denositing themselves directly in the suhmucous coat, probably in one of the lymph follicles An area of acute inflammatory change with fibrin ous exudate and polymorph infiltration then forms in the submucous coat This rapidly extends in depth always more or less hamorrhage into the mucous membrane at this stage Such primary inflammatory segments multiply up and down the appendix, most often in the distal portion immediately beyond a normal somewhat acute bend. A small amount of exudate, at first catarrhal then purplent. and often mixed with blood, accumulates in the lumen If peritoritis is present at this stage it is of a plastic or noninfective type, the germs being restricted as yet to the mucous membrane All these changes may occur within twelve hours and they are found in the type of the disease known as simble uncomplicated acute appendicutes The process may retrogress, the exudate is absorbed, and only a small amount of pigmentation remains in the mucous membrane

On the other hand, the process may upread the vurious inflammatory for uniting with another until all the coats

over a large area are affected. At this stage the appendix is swollen and erect, its surface reddened and often adherent to surrounding parts, but beyond that little is to be seen Microscopically, the picture is that of spreading inflammation as seen in other situations for example in the skin in cellulitis. The various coats are permeated by a fibrinous evudate and inflittated with polymorphonuclear leucocytes. The continuities known as acute phigmoneus appendiculti, and, if localised abscesses form, acute suppurative appendiculti. Such abscesses may rupture outwards or inwards.

Areas of merons then form on the mucous membrane, appearing as patches staining more or less unforming with the acid dye, these on separation leave ulcers (alcreaine appearing and these on separation leave ulcers (alcreaine appearing the statis). Ulceration is rapidly followed by penetration of germs and extension of these to the perstoneal cost, causing an organismal or septic pentionists. The inflammatory process also spreads to the mesentery where thromolog is us set up in the vens. This leads to inflaration in the appendix itself, localized gangine and risplare of the vision. At this stage the organ is still further swollen, dark purple areas have formed with thick fibrinous exudate on the peritioneal jurface Gaping tears in the organ will yellow Previous/margins may occur. Sometimes the later gangineous process is are limited to a particular area, most frequently the dust Ind, which is swollen and bulbous, of a dark red or purpled colour with patches of fibrinous exudate on this surface.

If the earlier plastic peritoritis has led to adhesions extension of the germs to the surface will cause a localized pertonitis or per-appendical abscess. If no such adhesions have formed, a general peritoritis results

Occasionally in cases in which appendectiony is not performed the thrombi which have formed in the veins of the mesentery become infected with germs. Septic softening occurs, portions of clot are detached to be caught in the branches of the portal vein within the liver, setting up perial pylephiebitis and portal pyamue abscess Such is the picture in gangrenous appendicitis with its complications

At any of the earlier mentioned stages resolution of the process may occur One of the commonest results of an acute attack of the disease is adhesions of the organ to surrounding structures In this way it may become buried in scar tissue or merely united by its tin to some such organ as uterus, bladder, or abdommal wall, thus forming a band under which a loop of bowel may become strangulated Should ulceration have occurred obliteration of the lumen through the formation of fibrous tessue will inevitably result. Such an appendix will become reduced to a thin fibrous band Rupture of an abscess leaves a track through the muscular coat This may be traced as a fibrous scar Constriction of the lumen by some of the above causes may lead to bulbous dis tention of the distal portion and a cyst results Recurrent attacks of inflammation are not infrequent in appendices which retain their lumen. Occasionally a subacute inflammatory process is set up which continues for some time leading to the formation of a greatly thickened organ. In the thickening all the coats participate

Tuberculous appendicutes may be primary or secondary. The latter occurs in the course of a generalised blood unfection from some such focus as the lung or from the perinorum in tuberculous peritoritis. The appearances presented are the usual grey or yellow tubercles usually in large numbers on the serious coat.

The primary condition occurs as part of an ileo-caecal tuberculous infection, very rarely as an infection limited to the appendix itself. The appendix may show little that is characteristic of the disease, the appearances being merely those of a subscute appendictits. There is general enlargement, ulceration, and fibrous thockening and only later on peritoneal involvement. The lymphatic glands in the ileo-caecal ancle show cascous tuberculosis.

Actinomycons of the appendix is similar to tuberculosis in its distribution and appearance. The disease goes on to suppuration, adhesions form in various directions with the formation of fixtulous operangs communicating with skin, bladder or rectum. Secondary abscesses of a characteristic type may form in the liver.

The types and stages of the diseases may be recapitulated as follows:

A Acuts Appendicitis

- r Catarrhal appendicuts—inflammatory change chiefly located in the mucous membrane, not infrequently an extension from a similar affection of the large bowel.
- 2 Simple acute appendicutes—a patchy inflammatory change starting in the mucous membrane but pene trating rapidly and deeply into the other coats
- 3 Phlegmonous (suppurence) appendicuts—a diffuse inflammatory change an oldring all the coats of the viscus, sometimes associated with the formation of localized accumulation of pus which may rupture either into the lumen or on to the pentioneal surface
- 4 Ulcraftive appendicuts—a condition in which necrois occurs in the mucous membrane with formation of sloughs, which separate leaving ulcers. In this type the organisms penetrate deeply and reach the pen toneal surface.
- 5 Gangrenous appendicults—The inflammatory process has involved the mesentery and led to thrombous in reins, infarction and necrosis of large areas of the wall of the viscus. Rupture takes place and pen tomits is always present. Portal pylephlebitis and liner absects may follow.
- B Subacute appendicuts—a more prolonged type of the acute in which great thickening of the viscus occurs, often associated with repeated attacks of the acute type

- C. Chrome appendicuts—representing the healing stage of the less severe types of the acute variety, associated with thickening in some cases, in others with fibrous atrophy of the organ often also with adhesions to surrounding structures
- D Chronic specific appendicules—due to infection such as tuberculosis and actinomycosis

Mirrocopically, in the catarthal type there is distention of the vessels with blood, infiltration of the coats with exudate, which may be fibrinous, also with leucocytes There is, in addition, catarth of the mucous membrane, as evidenced by shedding of the gland cells

In the more sewere types of the disease the inflammatory changes are more sotense, there is necross of the mucous membrane with ulceration are present in large numbers There is also more or less marked peritoritis

Animal Parasites - The important animal parasites which may be met with in the intestines are -Protozoa Entamæba histolytica, causing the tropical form of dysentery, and Amaba cols, of little or no importance Trichomonas intestinalis and Lamblia intestinalis are flagellate protozoa occusionally associated with acute diarribers in the tropics Balantidium coli is an infusorian which sometimes causes an ulcerative colitis Worms (1) Trematodes—Bilharma hæma tobium, which may give rise to polypoid outgrowths of the mucous membrane of the rectum (2) Cestodes-Tania solium, the cystic stage of which is found in the pig Tania mediocanellata or saginata, the cystic stage of which occurs in the ox. Bothriocephalus latus, the cystic stage of which is found in the Dike (3) Nematodes-Ascaris lumbricoides. found chiefly in the upper part of the small intestine, occasion ally in the bile duct Oxyuris vermicularis, the "thread" or " seat " worm, found in the large bowel in children Ankylostoma duodenale, the "hook," tunnel," or "miner's" worm, found attached to the mucous membrane of the jejunum Time worm is of more importance than the other round worms, as it may cause a severe type of anzima Tricho cephalus dispar, or "winp" worm, a common inhabitant of the creum

Tumours — Simple tumours, such as fibromata, lipo mata, myomata, and cysts of various kinds, are occasionally met with Of malignant tumours, sarcomata are rare

By far the commonest type of growth in the bowel is the caretnoma. Of these, all types may be met with squamous epitheliomata in the rectum, the various types of adeno-carcinomata, as columnar cell carcinoma, colloid cancer, scirthous cancer. The growth is usually small. It may be a mere ring of infiltration round the wall of the gut, producing a constitiction when looked at from the outside, with narrowing of the fumer. In other cases it forms a fingating growth projecting into the intenor (Fig. 6c). Ulceration of the bowels is very commonly associated, and perforation may occur. There are often adhesions with neighbouring structures, and the nearest lymphatic glands are usually colarged and infiltrated. Secondary growths in the liver are very commonly present. Diffusion of the growth throughout the pertioned cavity is sometimes seen

As regards are, extenomata may occur at any part of the small or large intestine. They are, however, much more common in the latter, occuring more especially at points of narrowing of the gut, such as the flience call valve and the ascending colon immediately above the executing at points where the intestine changes its direction, as, for example, at the hepatic, splenne, and signoid flexures. A harge proportion of cases show the growth in the lower bowel, usually a to suches from the anal orfider.

The appendix is occasionally the seat of a malignant growth of the adeno-caremoma type. This growth seems

to arise in appendices which have been previously inflamed and are partially obliterated. Such timours show little tendency to spread, being apparently of low malignancy. The term aranoid has been suggested for these growths.

DISEASES OF THE PERITONEUM

Hæmorrhage—Small petechal hæmorrhages occur into the subperitoneal tissue in micetive conditions and in severe anæmias. Free blood and blood dots in the peritoneal cavity may be due to rupture of an organ (liver or spleen) from injury, acute pentonits, rupture of a vascular tumour, as, for example, in the spleen, or rupture of an aneurysm

Dropsy of the Pertoneal Cavity or Assites —This condition may be found in diseases which tend to produce dropsy elsewhere, such as chronic heart and rend disease, or it may be due to arrhors of the firer. In long standing cases the pertoneum is frequently opaque and thickened. The fluid is usually clear, when it is milky the turbulity is usually caused by the presence of protein bodies of the nature of globul is. Very rarely milkiness is due to the presence of fat globules (chylous societs) escaped from an injured lacteal versel (e.g. in filarassis).

Acute Peritouits—This may be due to (t) spread of inflammation from structures within the abdomen, such as the appendix and Fallopian tubes or from the pleura, (2) rupture of the gut from injury or perforation associated with ulceration, (3) blood or lymph infection. It may be general seed throughout the peritoneal cavity or localised by adhesions

Naked-rye Appearances —There is more or less free fluid in the cavity, more especially in the pelvis and independent parts. The fluid may be yellow or brownish and contains flakes of lymph. It is often mixed with feeal matter or stomach contents, and usually has a foul smell. The omentum is swollen and its vessels mixeted. There is fibrinous exudate.

on the surface of the bowel, more especially between the coils of the intestine (Fig. 68) The coils are thus glued together Not infrequently on *eparating the coils small abscesses are one of into

Misoscopic Appearances of the Omentum in Case of Persionists — There is discission of the weeks, exudation of fibrin on the surface and in the substance, swelling and throwing off of the endothcial cells. These are found amongst the fibrin threads as large, swellen, and vaccolated cells, often containing germs and polymorphosuclear lecocytes. Numer our polymorphs are found in the fibrin on the surface and militrating the tissue generally. There is seeling of the collections of lymphood tissue along the vessels, and many free lymphocytes are found in the exudate.

Film preparations of the exudate show numerous poly morphonuclear leucocytes in various stages of degeneration, arge monoauctear cells often accolated and frequently con taining leucocytes which they have ingested, lymphocytes, and moreo-pressures

Chrome Peritonitis —Large or smaller areas of thickening of the peritoneum, or rather of the subendethelal fibrous
tissue of the peritoneum, are found frequently, more especially
over liver and spicen. They may be associated with adhesions,
and are specially frequent in syphiles. A more general
thickening of the peritoneum is found in cases of long-standing
secrits.

Tuberculous Peritonitis —This may be associated with tuberculous ulceration of the board, but not infrequently no such tesion of the bowd can be found Unully, however, the mesentenc glands are the teat of tuberculous The condition may also occur as a part of a generalised blood infection.

Naked-eye Appearances—The coils of the intestine are commonly adherent more or less firmly to one another. On separating the coils, if this be possible, there will be found covering the surface of the bowel and mesentery, also the surface of liver and spleen, as well as the parietal peritoneum, numerous small opaque white or yellow areas, the size of a pin head or larger (Fig. 70). Often the coils of bowel are too firmly adherent to one another to be separated without tearing. The great omenium is thickened, drawn up and infiltrated with grey tubercles. Occasionally free fluid may be present. The matting of the intestines leads to interference with peristalisis. Adhesious may lead to the formation of bands under which loops of bowel may subsequently become strangulated. Occasionally rupture of the bowel may occur as the result of erosion of the wall from the peritoneal aspect.

Mucrosopically, the appearances are those characteristic of tubercle. Giant cells are often specially numerous and well developed.

Tamours—Growths primary in the peritoneum are rare Endotheliomata are met with occasionally growing in the form of multiple polypoid masses. Dissemination of carcinoma sometimes occurs secondary to rupture of a cystic growth of the ovary or the invasion of a bowel tumour into the peritoneal cavity.

CHAPTER IX

DISEASES OF THE LIVER BILE PASSAGES AND PANCERAS

DISEASES OF THE LIVER

Post-Mortem Changes —In addition to the softening of autolytic change seen in cases examined some time after death the liver very frequently shows a greenish black discoloration (neudomelanoss) due to the formation of sulphide of from The change is most marked in those portions of the organ, such as the inferior surface which come into contact with hollow viscers. An incision will demonstrate that the pigmentation is superficial.

The blood in the liver vessels should be examined for gas bubbles which is due to the invasion of gas producing germs after death. Should this invasion take place before death emphysema of the organ (feamy liver) due to the presence of gas cysts is produced.

Deformities—A transverse sulcus across the lower por tion of the right lobe of the organ is frequently seen, due to the wearing of tight corsets Perpendicular sulci are also met with, due to folding of the liver from a similar cause

Wounds and Engine —Penetrating wounds, guishot or stab, are not uncommon. Tears due to crushing of the abdomen through accident or at birth also occur. It any large vessel is ruptured death rapidly supervenes owing to hiemorrhage into the pentioneum. Smaller injuries may heal leaving a sear Spontaneous rupture occasionally occurs in tumour formations. Should the tumour be vascular the hiemorrhage into the pentioneal cavity will be severe

ALTERATIONS IN THE CIRCULATION

- r Anzmia —Yellow or white patches are frequently seen on the surface of the organ They are due to localised anzema from pressure
- 2 Chronie Venous Congestion.—This condition is found in cases of chronic valoular disease of the heart and in chronic palmonary lesions. The organ is enlarged in the early stages. In the later stages it may be smaller than normal it has a dark purple colour with paler areas (Frontispiece, Fig. 5), and is firmer than usual. On section, the cut surface shows a mottled appearance, likened to nutmeg. There are areas of congestion, dark purple in colour, and areas of fatty change, pale yellow. The branches of the hepatic vein are didated.

Alterscopic Apparantes —In the very earliest stage there may be little more than the deposit of yellow pigment in a zone of liver cells round the central ven. In the later stages there is dilatation of the central vens and the capillaries draining into them, with compression and atrophy of the columns of liver cells between The liver cells, more particularly those at the margin, may show fatty infiltration. There is some increase of the fibrous tissue of the organ in the more advanced cases.

3 Embolism and Thrombosis in the Portal Vein — Thrombosis of the portal vein is sometimes found in connection with cirrhoes of the liver and malignant disease. It may also occur as the result of inflammation round a perforating uter of the storagch.

Portions of thromb from rootlets of the portal ven in the neighbourhood of inflammatory foot, e.g. the appendix, are caught in the branches of that vein within the liver Secondary thrombosis occurs in connection with such emboli, the condition sometimes spreading to large branches of the vein As the emboli contain organisms, abscess formation is set up

As regards the effect upon the liver of blocking of a branch of the portal vent, this may be very slight, owing to the fact that the liver lobule is also supplied with blood from the hepatic artery. Sometimes the area supplied assumes a darker brown, even a red colour, but on microscopic examination little is seen in such an area beyond dilatation of the capillaries. The liver cells commonly show no evidence of necross Occasionally, however, m such an area a partial necross of the inner two-though of the libroid soft the lobule may be seen

Blocking of a branch of the hepatic artery may lead to true inflarction. Only one case of this kind has come under the author's notice. The case was one of peraireritis nodosa in which there were insulaple aneusysms along the course of canous viscerial arteries. One of these, the suce of a bean, on the hepatic artery just within the liver was completely blocked by a thrombus. A large area of here rissue in the distribution with this vessel was the seat of anamous inflarction. The inflarct was wedge-shaped, pale in colour, and on microscopic examination the liver cells failed to stain. At the margin of this area the liver tissue was inflitrated with blood and showed an appearance similar to that found in the red stage of acute strophy. The student should remember, however, that true inflarctions of the fiver are exceedingly rate. The condition which he is most apit to mistake for an infarct is a externous angona.

DEGENERATIVE CHANGES

I Atrophy—Atrophy of the liver occurs in conditions such as cachexia and general malautinion in which the other organs of the body are similarly affected. If also occurs in old age, when the reduction in size is usually associated with increase in pigmentation (brown atrophy). The pigment is found in the form of granules without heave cities of the

central portion of the lobule It gives no iron reaction but stains with Sudan, thus revealing its lipoid nature

Acute atrophy (often known as acute yellow atrophy) is dealt with under a separate heading (p. 231)

2 Cloudy Swelling —This is found in varying degrees in all infective conditions, and occasionally apart from infections, as in hismorrhage of the pons where there was a markedly raised temperature during life

The organ is shightly enlarged and has a pale appearance it is soft and frable. The last point is tested by the ease with which the finger may be pushed into the substance of the organ. On section, the cut surface has a hazy, misty appearance, described as like the effect of plunging a portion of normal liver into boiling water. The outline of the liver lobules is no longer visible. The condition may be associated with congestion of some of the vessels of the organ. It is also commonly combined with a degree of fairty change.

Miscratopic Appearances —The liver cells are swollen and granular. In the fresh condition the nuclei are obscured by the granules, but these are reachly dissolved with dilute acetic acid, when the nucleus is rendered visible again. The cells often show a tendency to separate from one another owing to solution of their cement substance. There may be some infiltration of the portal spaces with infiammatory cells.

The condition is usually complicated with some fatty change in the liver cells. The nucleus in the earlier stages stains more intensely, in the later stages it tends to lose its characteristic staining reaction with basic dyes.

3 Fatty Change - Two types of this condition are commonly distinguished -

(a) Fatty degeneration, by which is usually meant the breaking down of the chemical constituents, more especially the combinations of proteins with fatty compounds, under the action of some poison, chemical or bacterial

The organ may not be much altered in size or it may

be smaller than normal It as paler than usual, of a bright yellow colour, soft, and Irable On section, the prits showing more advanced fatty change are seen as opaque yellow areas These may be in the centre of the lobules, or they may form a zone at the periphery, or the change may be present throughout.

Microscopic Appearances — Sections should be stained with Sudan III, Scharlach R, or Nile blue sulphate. As ulready stated the change may be at the periphery of the lobule in the centre, or throughout It is usually described as occurring most characterisacilly in the centre. The globules of fat in the cells tend to be numerous and small. The nucleus shows degenerative changes either increased intensity of staining in the early stages or loss of staining section in the more advanced condition.

(b) Fatty infilization may be defined as the absorption in excess of fatty material and the deposition of it in a demon strable form in the protoplasm of the liver cell. A rigid distinction between this and the preceding type cannot, however, be made. The two conditions pass into one another and are frequently combined. Thus there is reason to believe that in the fitty degeneration of phosphorus poisoning the fat in the liver cell is largely derived from out side. Hence in very many cases it is safer to use the term fruly change. It is convenient, however, in certain cases to make a distinction into two types, the extremes of which are readily extracted from one another.

The organ tends to be larger than normal, in some cases very markedly so It is pale yellow in colour (Frontispiece, Fig. 2). Its consistence varies in different cases. It may be softer and more firable, or it may be (in cases where there is currhous combined) firmer. On section, the change may appear most marked in the periphery of the lobule, or it may be diffuse.

Microscopic Appearances —The globules of fat within the liver cells tend to be large pressing aside the protoplasm and nucleus of the liver cell. The change may be at the periphery of the lobule, i.e. merely an exaggeration of a change found normally in the liver duning digestion, or it may be diffuse It is frequently combined with increase of fibrous tissue in the orkan

4 Focal Necrous—Areas of focal necrous are found in the liver in typhoid fever celaropsia and other toxic and infective conditions. They appear as opaque white or yellow points scattered through the liver substance, but often they are too minute to be seen with the unaided eye. Cloudy swelling is always associated.

In eclampsia the liver shows three characteristic changes, which may not, however, all be present in a given case (see p 343)

- (1) Hamorrhage under the capsule, which may be very extensive, also hamorrhage into the substance of the organ
- (2) Faity change, usually most marked at the margin of the necrotic areas
 (3) Areas of facal necrosis, usually situated at the periphery
- of the lobules, and often too small to be seen with the naked eye
- 5 Amyloid (Waxy) Degeneration For causation of waxy change see p 124

The organ is commonly enlarged, often very much so It is anzime and has a translucent appearance if the condition be advanced. It is firm and elastic in consistence like india rubber. On section, the cut edge remains sharp. The cut surface has the same translucent appearance. The condition is often combined with some degree of fatty change. When the cut surface is treated with a solution of iodine, the waxy areas take on a mahogany brown colour (Frontispiece, Fig. 4).

Microscopic Appearances -The waxy material has a clear

translucent appearance in unstained specimens. In preparations treated with methyl violet it shows a rose pink to purple colour

In the early stages the change is limited to the middle coats of the branches of the bepairs arisens and portal venus in the portal tracts. It is the bands of counterior issue between the muscle fibres which show the change. Later on, the per-endothelmal connective issue of the capablayers in the middle rone of the boulest is affected. Still later, the change becomes diffuse. The capablanes and also the liver cells become compressed by the swollen amplied maternal, and occasionally futtle or nothing is seen in certain areas but masses of wary tissue.

6 Pigmentary Changes.-A black coloration of those portions of the organ nearest the intestines is often seen. due to the action of the II,S from the gut upon the iron pigment of the organ This is, of course, a post mortem change. Increase in the amount of iron-containing proment in the liver is found in cases where there is an increase in the destruction of the red blood corpuscies within the liver, as in septicarmias and severe anximias, notably in permicious animia. This increase of harmosiderin pigment gives a yellow brown colour to the organ The pigment may be brought out in a striking fashion by pouring some ferrocyanide of potassium (2 per cent) over the cut surface of the organ, and then some dilute HO (1 per cent), repeating the process once or twice until the Prussian blue colour appears (Frontispiece, Fig 1) Microscopic sections of the organ should be treated in a similar way In chrome venous congestion, also in malaria, there is a deposition of pigment in the liver cells. In cases where there is obstruction to the ortflow of the bile there is a vellow coloration of the organ, which becomes green on exposure to the oxygen of the air (Frontispiece, Fig 3) The bile pigment may occur as a diffuse staining of the cell protoplasm or as eranules within the liver cells. Usually it is also visible

distending the smaller bile chancels in the form of rounded homogeneous globules green in colour, often known as bile thrombi

ACUTE INFLAMMATIONS OF THE LIVER

- r Acute Perihepatitis is found as a part of a general pentonitis. The surface of the liver is covered with more or less fibrinous exudate
- 2 Acute Hepatitis Acute inflammation of the liver substance is found in slight degree in all infective fevers. It is always combined with cloudy swelling, and may be associated with focal necrosis, as in typhoid fever. The evideoces of inflammation are usually slight, being coofined to infiltration of the portal tracts with inflammatory cells.
- 3 Suppurative Hepatitis—In discussing the types of liver abscess the paths by which organisms may reach the liver should be called to mind. There are three, (a) the hepatic artery, (b) the portal vein draining the whole of the abdominal contents, (c) the excretory duct of the organishe bile dud. Thus at ooce we may distinguish three types of abscess or suppurative hepatitis.

There are, in addition, three other types to which special names are given

Types of Liver Abscess

- 1 Pyæmic
- 2 Portal pyæmic.
- 3 Biliary
- 4 Actinomycotic
- 5 Tropical
- 6 Suppurating hydatid cyst
- (1) Suppurative Hepatitis of Arterial Origin—Pyamic Abscess—This type is found in cases of pyamia, septicamia,

and ulcerative endocarditis, where there are organisms circulating in the blood of the body generally. The abscesses in this case are minute and usually numerous. They are scarcely visible to the naked eye, and there are similar abscesses in other organs.

(2) Supparative Hepatitis of Portal Origin—Portal Pyamic Abstess—In this type the infective agent comes to the liver by way of the portal evan If its usually a germ Indienthrombus from a thrombosed evan in the neighbourhood of an inflammatory focus, such as an appendictive The abscesses in this cace are usually about the size of a pea They occur in groups or clusters like bunches of grapes (Fig. 7:) They form cavities containing yellow or greenish pus, their walls being formed of nercosed liver tissue Septic thrombic can usually be found in branches of the portal vein (Fig. 7:) The condition is 9 monthress known as bortal overally.

(3) Suppurative Hepatitis of Bile Duct Origin—Billiary Abstess —This is associated with suppurative cholongitis (suppurative inflammation of the bile ducts), which is commonly caused by obstruction to the bile passages from the presence of gall stones or a tumour The abscesses are numerous, insually minute and scattered uniformly throughout the organ The liver is bile stanned Cirrhous of the liver is not infequently present in addition

(4) Advisions cote Abscess —This type is usually a special variety of the portal pyranic abscess. It is associated with a focus of infection with the Shréphölvis achinomyers in some part of the intestinal tract, e.g. the vermiform appendix. The affected portion of liver has a worm-earth appearance owing to the presence of numerous small curvities containing pus, with areas of necrotic liver around, in which there is some fibrous:

(5) Tropical Abscess—This is usually single and fairly large (Fig 72) The process is more a necrosis of the liver substance than a true suppurative inflammation. The

contents of the abscess have a punk colour and creamy consistence. The condition is commonly associated with roppical dysentery. The Entanacha histolytica is found in large numbers in the tissue in the margin of the abscesses, and usually in the pus also.

(6) Suppuration in a Hydatid Cyst—In this case also the abseess cavity is large and may be solitary. Mixed with the pus there will be the ectocyst of the parasite. The cavity is usually limited by fibrous tissue.

ACUTE AND SUBACUTE LIVER ATROPHY

This is a condition which is associated clinically with jaundice, vomiting, a diminishing liver dulness, and eventually coma It is often connected more or less closely with such diseases as syphilis, tuberculosis, and influenza, and a number of cases have developed in women during the later months of pregnancy There is a general consensus of opinion that the condition is a toxic one, but what the nature of the toxin is and where it ongunates has not yet been determined A change indistinguishable from acute atrophy was occasion ally found in fatal cases of jaundice amongst workers in trinitrotoluol and tetra-chlor ethane during the war. A number of instances of the disease have occurred after the intravenous injection of arsenical preparations. As these were primarily cases of syphilis some doubt has been thrown upon the arsenic as a toxic factor. Phosphorus poisoning produces a change somewhat similar to acute atrophy, but chemical analysis of the phosphorous liver shows a great increase in the amount of fat, whereas in acute atrophy the amount of fat is usually not above the normal Although in acute atrophy at a certain stage of the disease fat can be demonstrated microscopically in large amount, having been set free from combination with protein, the change is much. more a necrosis than a fatty degeneration. In delayed chloroform poisoning the appearances in the liver are somewhat similar to those seen in phosphorus poisoning, but the change, as in phosphorus poisoning, is more of a fatty degeneration than a necrosis Some recent German writers emphasise the importance of an ascending infection from the alimentary canal by the bile channels in cases of acute atrophy

Two stages in the disease may be recognised, and, as a result, two types of cases are met with fost mortem

(1) Acute cases in which death occurs within one or two weeks of the onset of the symptoms, and in which degenerative changes predominate in the liver. There is usually little evidence of overgrowth of fibrous tissue. To this type the name "acute yellow atrophy" or ' acute liver atrophy" is more particularly applicable

(2) Subacute cases, lasting some weeks, or even months, in which there is more or less evidence of the reformation of functioning liver tissue with overgrowth of fibrous tissue For such cases the terms "subacute yellow atrophy," "sub acute liver atrophy," and for the cases with marked regenera tion "multiple nodular hyperplasia," have been suggested

(1) Acute Atrophy-Naked-eye Appearances -The liver is reduced in size, often markedly so Its cansule tends to be shrivelled. The organ shows, as a rule, areas of different colours, yellow and red In the more acute types the sellow areas predominate.

Microscopic Appearinces -In the yellow areas the liver cells are usually visible, but they show marked evidence of desenerative changes. They are swollen, granular, frequently contain fatty plobules, and their nuclei have to a great extent lost their staining reaction. In addition, there is usually more or less overgrowth of f brous tissue extending from the portal tracts. This f brous tissue is vascular and cellular. In the neighbourhood of the portal tracts are small vermiform strings of cells whose nucles stain deeply Sometimes these have an obvious lumen They represent the remains of pre-existing and of proliferating small bile ducts. In process of degener ating the liver cell undergoes coagulation of its substance, followed by disappearance first of the carbohydrate and fatty elements, second of the albuminous constituents.

In the red areas hitle that is characteristic of liner structure remains. The tissue is a vascular connective tissue with diated capillaries, and shows large numbers of endothelat cells which may contain pigment, a loose connective tissue stroma, occasional degenerated liver cells scarcely recognisable as such, and a few leucocytes. In the neighbourhood of the portal tracts the small bile ducts are numerous, and may show evidence of proliferation of their cells (mitotic figures).

(a) Subsente Atrophy — Naked eye Appearances — The organ is of a brownish red colour, with yellow or greenish nodules varying much in size, sometimes projecting beyond the general surface (Fig. 73). On section, these yellow nodules may be soldated, or may be found scattered through the substance of the liver. Where the nodules are numerous the organ presents the appearance of a coarse carrhouss, from which condition it is often very difficult to distinguish it.

Microscopic Apparaentes —The red brown portion of the organ consists of a farly wascular connective ussue with groups of small bile ducts, scattered endothelial cells, and, as a rule, with no liver tusue to be found. The yellow nodules present the appearance of liver ussue. They are composed of masser of liver cells, sometimes arranged in columns, at other times closely packed together. Lobular arrangement is imperfect. Many of the cells are large and multimucleated, some may be found showing mitotic division of their nuclei. The appear ances at the margin of these nodules suggest that they are enlarging and pressing aside the surrounding tissue. The follows tissue, being newly formed, contains few clastic fibres.

It will thus be seen that the disease is essentially a degeneration of the hver parenchyma under the action of some poison. Complementary to this, there is an overgrowth of fibrous tissue starting from the portal tracts. The condition may thus be regarded as an acute cirrhosis It forms a connecting link between the purely degenerative changes, such as occur in phosphorus poisoning, and the chronic interstitual milaminations or cirrhoses

Following the degenerative changes, attempts, more or less successful, are made to regenerate liver tissue in two ways (t) By proliferation of the bile ducts. This, although it is an imitation of the way in which the liver lobules are produced in embryonic life, seldom results in the formation of liver parenchyma. (2) By proliferation of liver cells which survive the destructive milence of the position, with resulting formation of nodules of glandular cells more or less resembling in structure liver lobules, and probably functioning as such.

Healing and Regeneration.-After myury and destruction of its tissue the liver is capable of a very complete renewal of its substance. The author has in his museum a liver the right lobe of which is almost entirely destroyed by a syphilitie gumma, while the left lobe has enlarged to approximately the same size as the right is normally. Any slow destruction of the liver tissue is accompanied para passu by regeneration This is seen in conditions such as chronic venous congestion and carrbosis The large size of some of the nodules in the latter condition is due in no small degree to regenerative hyperplasia After massive destruction of liver tissue as in acute and subacute atrophy if the patient survive, regeneration is often wonderfully complete but awing to the fibrous tissue laid down in the atrophic stage the individual areas of regenerated tissue are separated more or less widely by bands of fibrous tissue. This condition of multiple nodular hi berplana is in its more complete form almost impossible to dis tinguish by the unaided eye from cirrhosis Microscopically, in the regenerating areas in all these conditions there is a loss of lobular arrangement, the liver cells are larger and frequently contain more than one nucleus Nuclei are rarely

seen in the condition of initiosis, however. The regeneration of the liver tissue takes place from two sides, chiefly from the pre-existing liver cells, but also from a multiplication of the small bile ducts. It is only after a linking up of these two structures that the newly formed liver tissue can function

CURONIC INFLAMMATION OF THE LIVER

Carrhogia

The term "curheas," introduced by Laennec, simply means "yellow" It has, however, come to be synonymous with fibrosis, and is applied to all conditions of the liver in which there is abnormal development of connective tissue.

The condition is caused by any slowly acting poison or irritant. Thus chromic interactions, such as alcohol or lead, produce it Infective conditions, such as sphulis, may also cause it Retention of the bile from obstruction to the bile ducts will produce it, also inflammatory conditions of the mall bile ducts, which so commonly accompany obstruction. Lastly, abnormal accumulation of pigment, as in malaria, chronic venous congestion, and hemochromatosis, is a factor.

The liver consists of two types of cellular elements (i) highly differentiated and functioning gland cells very six expublic to the action of possons, and capable of little in the way of reaction, (c) cells less highly differentiated—connective-tussue cells—not so readily damaged by the action of possons, and capable of reaction and probleration in circumstances where the liver cells degenerate. The mere disappearance of the glandular cells is followed by a complementary pro-liferation of connective tissue. This is well seen in the less acute types of liver artophy. But where there is an irritant constantly present, as in syphilas, alcoholosin, retention of

bile and inflammation of the small bile ducts another factor comes into play, namely, the proliferative reaction of the connective tissue cell under irritation. These two factors are, no doubt, both operative in the production of cirrhosis of the liver.

Where there is any great amount of destruction of hepatic gland cells the stimulus to regenerate is felt by the organ, and is answered by the formation of new areas of liver tissue. This is a prominent feature in subscute liver atrophy, and evidence of it is usually present in cirrhoss also

Classification—The terms ronolobidar (where the areas of liver cut off by bands of fibrous tissue represent single lobules) and polybobidar (where such areas represent groups of lobules) are often used to characterise types of cirrhos is They are practically the same as fine and coarse cirrhosis respectively. They are not very useful as a basis of classification owing to the fact that the two conditions are usually too be seen alongside one another in the same liver. Another couple of terms used sometimes are hypertrophic (meaning an althornally large liver) and atrophic (abnormally small). Owing to the fact that in many instances it is impossible to decide whether a live is enlarged or not these terms are rather to be avoided. The method of classification adopted is as follows.—

A Common Cirrhosis —The ordinary type found in asso crition with chronic intovications distinguishing (a) an early stage where the liver is large and (b) a late stage where it is small. This variety is usually polylobular.

I Early Stage—The liver is evilarged and has a somewhat rough surface. In some cases it is red from congestion, in other cases it is yellow, from fatty change.

The organ is firmer and tougher than normal and on section shows bands of vascular fibrous tissue running through it. These, as a rule, are not very obvious

Microscopic Appearances —Bands of vascular and cellular connective tissue divide up the liver into areas, at one time representing a single lobule, at another time a group of lobules. The liver cells may show little change, or there may be more or less fatty infiltration.

2 Advanced Stage—This is the more common type of the disease, known as "bobnal," "drunkard's," or "gin drunker's" liver, also as atrophic currhosis

The liver is distinctly reduced in size. It has a roughened surface, owing to the presence of nodules varying much in size. It usually has a pale yellow colour. The capsule may be thickened. It is distinctly tougher and firmer than normal. On section, it shows bounds of grey fibrous tissue passing through the organ in all directions, dividing it up into rounded areas varying much in size (Fig. 74). A number of cases are recorded in which primary carcinoma of the organ was associated with this type of cirrhosis.

Microscopic Appearances -- The most striking change is the overgrowth of fibrous tissue which spreads from the portal tracts, forming bands, thicker or thinner, cutting off individual lohules or groups of lobules This fibrous tissue is well formed, but it often shows here and there accumulations of small round cells, indicating that the fibrous proliferation is still progressing There is considerable development of new elastic fibres in the bands of fibrous tissue There is a varying number of small bile ducts. These in some cases appear to arise from retrograde changes in columns of liver cells, the latter reverting to their embryonic condition under the pressure of the surrounding fibrous tissue. In other cases the ducts represent an attempt to reform liver tissue, just as in subacute liver atrophy There is a tendency for the fibrous tissue to invade the liver lobule at its margin to a certain small extent, individual liver cells or groups of them being cut off. The liver cells themselves commonly show more or less fatty infiltration Not infrequently small nodules of regenerated liver tissue are met with. These are recognised by the evidence of multiplication in the liver cells, some of them having two nuclei, others showing evidence of division Such nodules also show imperfect lobule formation

B Biliary Curthosts —The condition is commonly associ ated with obstruction to the bile ducts. This may be due to congential obliteration, to gall stones, or to tumour It is also very commonly associated, as, indeed, obstruction is, with inflammatory conditions of the bile ducts.

The organ is sometimes enlarged, sometimes reduced in size I its surface is not so rough as in common circuloss. It is a much finer currious, corresponding more to the monolobular type. The organ usually has a deep yellow colour, turning green on exposure to the air, due to the bile stanning which so constantly accompanies it. The organ is firmer and tougher than normal. On section, bands of fibrous tissue can be seen radiating through the liver tissue and dividing it up into small lobules which have a yellow or green colour. Sometimes abserts formation of bilary origin is present. Clinically the condition is characterised by en larved silven and juanchee, but not by ascites.

Misratopic Afficiances —As in the common type, the most striking change is an overgrowth of the fibrous issues of the organ, extending from the portal tract and tending to separate andwalail zero lobules from one another. The fibrous issues is, on the whole, more cellular than in the common type of cirrhous, and small blied ducts are a more conspicuous feature. The liver cells show marked degenerative changes, areas of necross being frequently met with. The pigment may be seen in and between the liver cells. Catarrhal changes in the bile ducts, sometimes with the development of abscesses, is common. In suitably standed specimens germs may be found, especially where abscess formation is present.

C. Hanci's Cirrhosis —This is a rare condition character used climeally, like the bidary type, by jaundace and enlarged spleen, but not by ascites The liver is greatly enlarged, is tough in consistence, but the surface is smooth. The cut surface is yellowish red in colour and shows no obvious bloula too. Microscopically, there is increase of fibrois usue

within the lobules as well as between them The structure of the organ thus has to a great extent disappeared owing to the liver tissue being broken up into small groups of cells

Another rare type of curhosas occurs in relation to excessive pigmentation of the liver with harmonderin. The disease is known as hermochromatoris, and the pigment occurs in other tissues such as skin, pancreas, and testicle. The liver senlarged, firm, and brown in colour, with a rough surface is

Cirrhosis of the hver is also an accompaniment of Banti's disease and of the rare cerebral affection, Wilson's disease, which is primarily a degeneration of the two lenticular nuclei

D Syphilitic Cirrhosis (see Syphilis)

Results of Cursous —Owng to the pressure of the con tracting fibrous ussue upon the branches of the portal year within the liver, there is obstruction to the blood passing through the organ and coming from spleen and bowel, with the following results —

- 1 Ascites or dropsy of the abdominal cavity
- 2 Chronic venous congestion of crophagus, stomach, intestine, and spleen, with a tendency to chronic catarrh, vancose vens, hamorrhage, and, in the case of the spleen, enlargement

These two changes occur especially in common cirthosis

3 Jaundice, which is more characteristic of biliary

Syphilis of the Liver

(a) Congental —In this type of the disease a diffuse cirrhotic condition is sometimes not with (congental syphilitic cirrhosis) The organ is enlarged, commonly bilestained, firmer than normal, but otherwise little altered

Microscopic Appearance — The organ is the seat of a some places than mothers. It is not specially restricted to the portal tracts, on the contrary, it is found within the lobule senarating rouns of cells and sodredual cells from one

another In the fibrous tissue are to be found numerous small round cells aggregated in places into small invises, sometimes with caseous centres (milary gumnata). In suitably treated material, spirochaetes may be demonstrated in large numbers

(b) Acquired -In acquired syphilis the lesions found in the liver are -

I Areas of chrome pershepalitis, sometimes with adhesions to the abdominal wall and diaphragm

a Gummate—These are caseous foci surrounded by a conchange radiating from it into the liver substance. They
may occur singly or in groups. They are frequently absorbed,
leaving behind sears which show themselves as puckerings
on the surface. When these are numerous, sometimes a
carrier circlatic conditions is produced, with marked deformity
of the organ. Waxy degeneration is sometimes combined
with the above.

Inherenlesis of the Liver

Tuberculosis seldom develops to any extent in the liver, that organ apparently not forming a suitable indus for the growth of the therele bacillus. Two types of the disease are found—

(a) Military Tuberculosis — Small scattered foci which may or may not be visible to the naked eye. When visible, they appear as minute white or yellow spots, sometimes they are bite-stanted. Similar areas are found in other organs.

Microscopic Appearance — Numerous cellular areas are scattered through the organ. They are made up chiefly of large and small mononuclear cells. They may have caseous necrotic centres or may show man cells.

(b) Larger carous nodules, which may be single or numer outs, and are usually bile-stained. This is a rare type, more commonly met with in children than in adults. Fibrosis of greater or less degree accompanies the disease. Thus some authorities distinguish a taberculous type of cirrhosis.

Leukamia of the Liver

The organ is usually enlarged, paler than normal, sometimes with distinct, small, whitish areas scattered through it

Microscopic Affreamers —There is infiltration of the liver substance with rounded cells, which vary in type according to whether the condition is myelzemia or lymphaemia. These cells are found in the portal tracts and between the columns of liver cells. In the more advanced cases the individual liver cells may be separated from one another. Here and there are cell accumulations without any liver structure. These are the above mentioned pale areas. The endothelial cells of the cardillanes are swollen.

Lymphadenoma (Hodgkin's Disease)

The liver may or may not be affected in this condition. When it is, numerous irregularly shaped pale areas similar to those seen in the spleen are scattered through it. The condition is sometimes indistinguishable from true tumour formation. In most cases, however, the pale areas are more diffusely distributed, smaller, and less well defined.

Microscopically, the appearance of the areas is similar to those found in the *pleen in the same disease (see p 129)

Tumours

A. Simple growths of the liver are not common. The caterious angioma is the one most frequently found. It appears as a dark red area under the capsule of the organ. On section, it is found to be more or less irregularly wedge-shaped. On close inspection, bands of white fibrous tissue may be seen dividing the area up into spaces filled with blood (Fig. 76). Its appearance is suggestive of an infarct, but it should be remembered that true infarction of the liver does not occur.

Adenomata of the liver are occasionally met with They appear as circular, well-defined nodules in the substance of the organ, yellow or reddish brown in colour They usually are single or multiple, and microscopically show an approxi

mation to the normal structure of the liner, but without the regular lobular arrangement. Areas of regenerated liver tissue have a somewhat samplar appearance Occasionally sample adenomata with acmous structure and originating from the hile ducts; occur Such have the appearance of gree, well defined nodules in the liver substance.

B. Malignant growths are very common in the liver

Primary gracits are not very frequent, but secondary gracits, more particularly carenomata, are very common The venous blood from the vanous portions of the bowel passes through the organ and is naturally strained of any embol, tumour or otherwise in it. Inasmuch as the malig nant growth of the bowel is almost invariably a carenoma, the second-ury malignant neoplasms of the liver are commonly of this type.

It is issued mossible with any great amount of certainty, to decide from its appearance whether a tumour is sarcoma or carcinoma primary or secondary. The growth, or growths, appear as white or yellow areas scattered through the substance of the organ varying in size rounded or irregular in shape. The liver is often greatly ralarged (Hig 28). In the tumour masses necrotic areas, and hemorrhiges are commonly seen. Owing to sinking in of the necrotic centres the masses on the surface often show crater like hollows. The intervening liver substance frequently shows hile-stanning, and occasionally circhosis. The connection between primary cancer and circhosis is well recognised.

1 Primary cancers of the liver are of two types -

(1) A type resembling more or less closely the structure of the liver, the tumour cells occurring in columns

(2) A type arising from the bile ducts and resembling other adeno-carcinomata

The association between primary cancer and cirrhosis of the liver has already been noted

2 Secondary cancers wary very much in appearance

and in character All types of adeno-carcinoma of the bowel—columnar cell, scirrhous, encephaloid, colloid occur, also chorionepithelioma

Of sarcomata (Fig 77) only the melanotic shows appearances which are distinctive

Cysts of the Liver

Congenital cystic disease is sometimes met with in the liver, although not so frequently as in the kidney. The cysts are numerous, vary in size, and contain clear fluid

Hydatid cysts are relatively frequent in the liver. They often attain a very large size, are surrounded with a fibrous capsule, and contain ecto and endo-cyst, with the characteristic "white of egg" appearance (Fig. 70)

Gar Cysts of small size, caused by the development of bubbles of gas in the liver substance through the action of an organism (B aerogenes capitalus, also called B Welchri), are occasionally met. They are found in association with suppuration in the abdominal cavity. Pressure upon the liver produces a sensation of cracking, such as is normally present in the lungs. Microscopically, spaces representing dilated vessels are found lined with a layer of bacteria. A similar change may be present in other organs, e.g. pancress.

The organism causing this condition is a normal inhabitant of the intestinal tract and is often found in the blood in cases where the sector is deferred for some time after death. The blood in such cases has a frothy appearance. Occasionally this invasion of the blood occurs during hie when the above appearances are produced in the liver and other organs.

METHOD OF EXAMINING A LIVER REMOVED FROM THE BODY

The general size, colour, and shape of the organ should be noted, also the appearance of the lobules as they shine through the capsule. The capsule is then examined for evidence of

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adhesions with the abdominal parieties, for depressions such as are produced by gummata, for the fine or coarse generalised roughening of circhosis, also for the filmonus resident of acute perstantiss and the essensistics of tuberculous perstantis. The organ is weighted, the normal weight of the liver being 45 to 36 or (1420-1649 grm). It is opened up by a series of perpendicular cuts. In so doing the consistence of the organ is noted. Pressure is made upon the cut surface in order further to investigate this point. The cut edge should be looked in an order to see whether it is rounded (indicating soft consistence) or sharp. The cut surface is then in vestigated as to colour, the presence of absects, tumours, etc., Lastly, the gall bladder is opened up, and the amount of bile, also its colour noted.

DISEASES OF GALL BLADDER AND RILE DUCTS

Post-Mortem Change—Gall bladder lesions should as far as possible be studed in fresh material obtained at operation. Owing to the rapidity with which post mortem change takes place autopsy material is sucless for demon strating the finer alterations of the mucous membrane. This rapid change is due to the action of the bile on the mucous membrane after death.

Gangenital obliteration of the common bile duet is a condition occasionally met with The exact cause is unknown, but it is believed to be, in some cases, syphilitio in origin It is associated with a fine currious of the liver and bile primeration of that organ as well as jaundice

Jamilee or Icterus—Although the subject properly belongs to text books of general pathology, a few works may be said about jaundice as it is seen in the post mortem room Jaundice may be defined as the absorption of the bule pigment into the blood with consequent staining of the tissue. In addition to the pigment the bile salts are absorbed, forming the chief toxica agent. In slightly marked cases the yellow tinge abould be sought for in the sciencia of the eye. In more marked instances there is a general yellow staming of the skin which in extreme cases assumes a greenish colour owing to the condition of the bilirubin and formation of bili verdin. The internal organs are more or less affected by the staming, taking on as a result a yellow colour which changes to green on exposure to the air. The organs and transitions most affected are been, kidneys, and endocardium. The utine, exudates, and transidates are coloured, and in marked cases of obstructive jaundice the stools are clay like in appearance.

The more important causes of jaundice may be classified into three groups I Jaundice due to obstruction to the entrance of blue into the intestine, as by swelling or thicken ing of the walls of the bile channels, the presence of an obstructing gall stone in the main bile duct, or the pressure of a timour, e.g. a carcinomo of the band of the pancreas

- 2 Jaundice due to diseases of the liver in which there is more or less destruction of liver tissue, e.g. acute liver atrophy
- 3 Jaundice due to increased destruction of red blood cells or to hamolysis, as in septicamia, pyramia, pneumonia, and permicious anamia. In this last type the yellow coloration is usually slight and may be limited to the neck and upper eart of the thorax

Inflammation of Gall Bladder (Cholecystitis), of Bile Ducts (Cholangitis)

Catarrhal Inflammation—A mild degree of inflammation of the bile passages is sometimes associated with a catarrhal condition of the stamach, and, owing to the low pressure at which the bile is excreted, blocking of the bile passages from swelling of the walls, with resulting jaundec, may occur. A similar condition is sometimes brought about

Difference of organisms such as the B typhonis in typhote fiver. The bacilli in all probability reach the bile ducts from the blood by way of the liver, but it is possible that they pass upwards from the duodenum. In the gall bladder and larger bile ducts a catarrhal inflammation is set up which may persist for months or years after the attack of fever. In many instances this inflammatory change leads to gall stone formation. When the typhoid bacillis is the caute of this condition the patient suffering from it is constantly voiding with his stools living virulent organisms, which may contaminate food or drink and lead to the dissemination of the disease. Such individuals are known as 'tothoid carriers'.

oppose certics:
Suppusative inflammation of the bile ducts (suppurative cholangita) is a very common accompaniment of obstruction to the outlet of the bile from gall stances or tumour formation. The organisms found are usually staply lower or B coli The condition results not infrequently, in abserves (bilary) within the liver substance. In cases of prolonged inflammation the walls of the bile ducts are therefore, and if obstruction is present they are distated.

Supparative Cholesystitus (empyema of the gall bladder)—
This may occur with or without challingtis. As a rule this
condition supervience after profonged or repeated attacks of
inflammation so that the wall of the gall bladder is thickened,
sometimes to a marked degree. The interior is congested
and shows areas of himorrhoge and more or less extensive
ulceration. If may pass on to necrosis and gangrees with
consequent acute personnts or it adhesions have formed,
suppurative inflammation in the tissues around Concretions are very commonly present in such gall bladders.
In the event of rupture these may escape into the perstoneum,
or by ulceration through adhesions into the large lowel

Dilatation of the Gall Bladder—Obstruction to the cystic duct usually by a gall stone leads to distention of the gall

GALL BLADDER AND BILE DUCTS

bladder The contents are turbed and consist of bile diluted with micros

Biliary Concretions or Gall Stones (Cholelithiasis)

Gall stones are much more common in women than in men, something like three-quarters of the cases occurring in the female sex. They usually make themselves felt about the age of forty, although, not infrequently, the stones are found post mortem without there being in the history of the case anything to indicate their presence. As regards causation, tight lacing, good living, and sedentary habits are predisposing factors, but the actual cause of the condition is commonly a catarrhal inflammation of the bile passages associated with the presence of organisms Aschoff distinguishes two types of gall stones (1) Those produced by congestion of bile and disturbances of metabolism, the stones belonging to this category consist almost entirely of cholesterm (2) Those caused by inflammatory change due to the presence of organisms. The germs which have been separated, in some cases actually from the interior of the stones themselves, are staphylococci, B coli, and B typhosus. The mode of formation of the concretions is as follows a nucleus of mucus and epithelial debris is formed. and round this are denosited cholesterin flargely derived from disintegrated epithelium), lime and magnesium salts, and bile trament Cholesterm is the main constituent, being present usually to the amount of 70-80 per cent, hence the lightness of the stones Some stones are formed almost entirely of cholesterm. The colour, which varies from pale yellow to black, depends upon the amount of bile pigment present The concretions vary much in size, from minute particles (rall sand) to masses measuring, it may be, two inches across Those formed in the bile ducts are usually small, the larger ones develop in the gall bladder Gall stones are usually

multiple, hence commonly faceted ($T_{\rm S}$ 80) Sometimes they have a mulberry like surface and occasionally they are smooth. The smooth stones are, of course, solitary. On section, the concretions often show concentric lamination, sometimes they exhibit radiating lines

As regards the effects of the presence of gall stones, they tend to keep up the chronic trritation which caused their formation Thus they fead to thickening of the gall bladder and bile ducts and to adhesions to surrounding parts. More acute, suppurative inflammation may be set up. They may ulcerate through into the intestine and, when very large, have been known to cause intestinal obstruction. They may obstruct the cystic duct, thus leading to atrophy, or, in some cases, to dilatation of the gall bladder They not infrequently obstruct the common bile duct and give rise to joundice Lastly, there is a very definite relationship between cancer of the gall bladder and the presence of gall stones Gall stones are also an important factor in acute inflammation of the pancreas. In spite of the frequent occurrence of pronounced fesions in connection with biliary concretions, it should be remembered that not infrequently a normal bladder filled with stones is found at an autopsy with nothing in the history of the case to suggest that the patient at any time suffered from symptoms associated with the gall bladder or bile ducts

Tumours.—The carcinoma is the most important tumour of the gall bladder. It is usually a columnar cell adeno-carcinoma, but may be a scribus or colloid cancer, or even a sinuanous enthelioma.

DISEASES OF THE PANCREAS

The pancreas is an organ which tends to show marked fost mortem changes, partly because of the action of the digestive juices which it secretes, partly because of its proximity to stomach and intestine, and so to infection with putrefactive germs Thus, just as in the case of the stomach, so with the pancreas, the pathologist must be careful not to regard as evidence of disease, changes which are merely due to altera tions taking place after death.

Where a lesson of the pancreas is suspected, careful search should be made for ureas of fat necross. Conversely, the presence of these areas of fat necross is evidence of a lesson of the pancreatic gland. Such areas are found in the fat of the pancreas itself, of the mesnetry and omentum, occasionally even of the mediastinum. They appear as opaque white spots the size of pin heads, or even as large as pear. The change in the fat is brought about by a setting free in the peritoneal cavity of the fat-splitting ferment of the pancreas. The neutral fat is at first split into fatty acid and glycerine, the fatty acid probably combining subsequently with a calcumb base.

Atrophy of the pancreas is sometimes met in old age and wasting diseases. In diabetes not infrequently the only alteration found is a diminution in the size of this organ. In old age, along with the diminution in size a brown coloration is observed.

Totle Change —Owing to the rapidity with which autolytic softening occurs in the pancreas it is difficult to demonstrate the finer alterations due to toxic change. Cloudy swelling occurs as in other parenchymatous organs, as also fatty degeneration. Another degenerative change, the result of the action of toxins or of exhaustion of the cells, is seen in the epithelial elements of the ulands of Langerhans in severe cases of diabetes. This condition, in which the cells are swellen and sacuolated, has been called hydropic degeneration.

Fatty infiltration, or penetration of fat into the substance of the gland, with atrophy of the gland tissue, is occasionally seen Hæmorrhage —Small multiple hæmorrhages are found not infrequently in toxic diseases. Larger hæmorrhages occur in association with degenerative and inflammatory conditions. Rarely hæmorrhage inflaretion may occur, most often in stout people, with escape of blood into the surrounding tissue, sometimes with sudden death ensuing from pressure upon the solar plevus.

Inflammation

A Acute Hemorrhages Poncreatius—This is a somewhat rare condition, the etiology of which is not quite clear. The symptoms are those of acute intestinal obstruction. In many instances it is an acute infecture process due to the presence of germa, and it is not infrequently found in association with cholangitis and gall stones which may be found blocking the ampulla of Pater. Regurgitation of bile into the pancreatic ducts occurs under these circumstances. This is probably the determining factor in the condition in such cases. Some regard the hemorrhage as the pinnary change, others consider that it is, like the fat necrosis, due to the setting free of the digestive juices of the origin and the action of these upon tye blood vessels.

As regards appearances, the organ is swollen and dulk red in colour, due to infiltration with blood. In the early stages the organ is firm. Later on, owing to degenerative changes, it becomes soft. More or less extensive fat necrosis is always lound in the fat in the neighbourhood.

Mirerropically, areas of necrosed pancreatic usive are found, also infiltration of the intercunous tissue with red blood corpuscles, fibrin, and leucocytes. The areas of fat necrosis are well brought out with Nile Blue, which stains the necrosed fat blue, the normal fut red.

2 Supporative Parareatitis—Organisms may reach the pancreas by way of the blood-stream or by the duct of Missung, or again by extension from neighbouring parts. The

abscesses may be minute and numerous or large and solitary Sometimes the change is associated with suppurative cholan gits and gall stones. The abscesses may rupture into the peritoneal cavity and cause peritonits

3. Girone interstitat pancreatitis or cirrhoris of the pancreas may be met with in association with alcoholism, syphilis, and obstruction to the duct of Wirsing by calculi or tumour formation. The organ is enlarged in the early stage. Later on it becomes reduced in size. In all cases its consistence is increased, it is pale in colour, and its surface more nodular than usual. In himmochromatosis or bronze diabetes, in addition to the fibrous change, there is pigmentation of the gland with himmosterin which gives to the organ a brown colour. In some cases of diabetes a fine fibrois involving more expecially the islands of Langerhams, has been described

Tumours—Primary carcinomata are occasionally met with By pressure upon the common ble duct such timours cause an extreme degree of jaundice Many of the cases of so-called malignant jaundice are due, not to a neoplarm in the pancreas, but to some secondary deposit in a retropen toneal gland in the neighbourhood. As a rule these carcinomata are of the encephaloid variety, but columnar cell and surmous types also occur.

Oysts—The pancreas, like the liver and kidneys, is sometimes the sext of congenital cystic disease. Such cysts are multiple and small Large solutary cysts are also met with, due in all probability to obstruction of a duct of the gland

Relationship between Lesions of the Pamereas and Dubekte— Since the middle of last entury a relationship between changes in the pancreas and the disease diabetes has been recognised. In 1889 it was shown by Minkowski that total extripation of the organ produced a fatal diabetes. Ligature of the duct was, however, not found to have this effect. As was shown by Schultze and also independently by Sscoolobey, complete blockage of the secreting ducts is followed by a degeneration which involves the cells of the acun, but not those of the sites of Langerhaus. It was this fact, confirmed by other observers, which led Banting in 1921 to the discovery of a hormone in the pancreas capable of lowering blood sugar in a marked degree. In evaluation that the sugar is a marked degree. In evaluation with Best, Danting ligated the ducts of the pancreas in several dogs a few weeks afterwards killed the animals, excused the partially degenerated gland still containing islet ussue, extracted it, and found that intracenous injection of the estract into depancreated animals caused marked lowering of the blood sugar and a fill in the sugar excreted in the urine. Thus the relationship between the settle bornone and the island tissue of the gland was established, and the demonstration of two types of tissue in the pancress with distinct functions completed.

Previous to the discovery of the active hormone, Opic described definite histological changes in the isless of Langer hans in patients dying of diabetes mellitus, but it must be admitted that these changes were by no means constant. They consisted in fibrosis and hyaline change in the connective tissue of the islet. The islet consists of a fibrous capsule with a delicate connective tissue reticulum carrying blood vessels, amongst which are epithelial cells having different tinctorial reactions. It may be that when the finer histology of the islet is worked out some constant alteration will be dis covered, but meantime it can only be stated that in some cases of fatal diabetes lesions of the pancreas are found, to others none, and the changes which are found are by no means con stant. In acute cases of diabetes in man a swelling and vacuolation of the epitbelial elements of the Langerbans islands has been described. This has been termed hydronic degeneration. In other cases the epithelial cells are small and atrophied, often the whole organ is markedly reduced in size. In the more chronic cases hyaline change in the islet tissue and increase of f brous tissue with pressure a rophy of the epithelial elements may be fourd. Sometimes the fibrosis is a more diffuse one involving the pancreas as a whole. such cases the term curbous is applied. This is associated with the presence of large quantities of hamosiderin sigment in hymochromatosis or bronze diabetes.

CHAPTER X

DISEASES OF THE KIDNEY AND BLADDER

DISEASES OF THE KIDNEY

Post Mortem Changes — The kidney rapidly undergoes degenerative changes after death, and if the sectio be not performed within a reasonable time it becomes very difficult to distinguish post mortem changes from disease. To the extreme form of this post mortem change the name autolysis given It affects the kidney epithelium primarily, the nucleus of the cells ceasing to stain and the protoplasm breaking up into granules and sometimes even into lipoid material which gives myelin figures.

Red (hemoglobin) staining particularly of the connective tissue of the organ is another post mortem change, and greenish black discoloration of the parts in contact with bowel also occurs from penetration with sulphuretted hydrogen gas and formation of sulphide of from

CONGENITAL ANOVALIES

Persistence of Fætal Lobulation is a fairly common finding It is best seen after stripping the capsule from the organ, and shows itself by a senes of intersecting lines dividing the organ into intervalvally shared areas

254 DISEASES OF THE KIDNEY AND BLADDER

Horse-shoe Kidney a condition in which the two organs are united usually at their lower end across the vertebral column, is not infrequently found

Congenital Gyatic Kidney—In this condition which is always billiated the organ is enlarged officen greatly so The outer surface is studded with projecting cysts, with transparent contents varying in size from something just visible, to a without In some cases there is very little kidney \uparrow $\Omega_{\rm g}$ left between the cysts On section a similar apply, we seem the cysts On section a similar apply, to see seen (Fig. 81). The condition is believed to be que to a fullure of union between the glomerular and the tubular portions of the kidney issue with a red eveloped separately. Solitary congenital cysts sometimes of large size, may be met with

Congenital Hydronephrosis may occur in one kidney owing to defective formation of the ureter

CIRCULATORY CHANGES

- I Hamorrhage into the ladies substance is a constant accompaniment of infarctions and acute influentatory con discuss such as abscesses. It occurs at the margin of the lesson, and is due to the escape of blood from degenerated capillaries. Hamorrhages were the glomenular space and into the tubules are a feature of some types of acute nephritis, the lessons appearing as rumute red points to the naked eye. A condition known to the surgeons as essential heamstrant, is of uncertain origin. The blood often in large quintities, is passed continuously or intermittently. When the kideep has to be removed to stop the bleeding, the origin is usually found to be almost normal. It is probable that the Heeding is from some fairly large vessed which is atheromatous.
 - 2 Chronic Venous Congestion .- This condition is found

in cases where there is obstruction to the passage of blood through the beart or lungs

Nahed eye Appearances —The organ is somewhat enlarged it is firm. On section, the medulla has a dark purple appear ance, the cortex is paler than the medulla, but shows dark knes and dots indicating it essels and glomerul. On stripping the capsule, the venus stellates are often very prorounent

Utersteepic Appearances —The vessels generally are dilated, more especially those of the medulla. The glomerular capil lartes are distended Sometimes hemorrhages into the tubules are seen Catarrhal and interstitual changes may be superad-led

3 Inferction.—Infarcts of the kidney are common They are almost invariably due to embolism of one of the branches of the ren ill artery. Occasionally the whole vessel may be blocked. The embolism may be caused by the impaction of portions lof thrombi from vegetations on the aortic or outral valve, thrombi in the left auricle or its appendix, or on athermatic our patches in the aorta. The infarcts are needge-shaped variets in the cortex, usually white or yellow in appear can a surrounded by a harmorrhagic zone, more especially one to they come in contact with the medulia. (Fig. 8.2)

TY (African a level with the rest of the surface Later on Lancel ness depressed, and eventually absorbed,

Very smile, ye used any scattered depressed areas are found on the surface so, all organ which, on section, prove to on the surface so, all organ which, on section, prove to due to interstinal city clearly blocking of vessels owing to disease This year of the surface of the same and the preferred to as and the provided of the same and the

Microscopic to france — The infarcted portion shows swelling granule to a more intense staming of the columnar cells of tubnles The nuclei usually are broken into masses of chromatin or fail to stam altogether. At the margin

found in association with Bright's disease and waxy degenera

Naked-eys Appearances—In the first condition there is usually no great alteration in size in the organ. On section, the cortex is pale opaque white in appearance, and contrasts with the more vascular medulla.

In the second variety the appearances depend upon the stage of the disease, and will be described in connection with the various types of nephritis and waxy change

Microscopic Afpearances —In sections stained by ordinary methods, such as huminen and cosis, the cells of the convoluted tubules appear swollen and granuler, and their nuclei may show degenerative changes. In sections stained with Sudan III or Scharlach R. the same cells will be found to show numerous far granules and globules, more especially in the deeper part of their protoplasm. In the callecting and other forms of tubules the same change will be found, but less marked.

- 3 Glyagenous degeneration occurs in the spitchial cells, especially those of the first part of Henle's loop and of the convoluted tubules in cases of diabetes mellitus. The granules can be brought out by the use of iodine in fresh preparations untrested with water.
- 4 Waxy (Amyloid)—This may be found in association with advanced tuberculosis, visceral syphilis, or chronic supportation, e.g. empyema, bone or joint disease.

The kidney is usually enlarged, in the more advanced stages very markedly so, although, when combined with interstitual change, it may be reduced in size it is pale from anaema and associated fatty change (frontispiece, Fig. 6). As a rule it is firm, and shows a sharp edge on section, occasionally it may be soft. The appearances are very similar to those seen in the subacute form of Bright's disease (large white kidney). In some instances it is possible to distinguish between the two conditions only on testing with iodine. Sometimes the elomerulic can be seen as munite translucent.

specks. In the more advanced stages the whole cut surface has a translucent appearance. On treatment with jodine the glomeruli and vessels are brought out as mal ogany brown specks and lines The capsule commonly strips well and leaves a smooth, pale, mottled surface

Microscoti ally, the change is observed first in the afferent artenoles (see plan, p. 261), it then spreads to the plomeruli and efferent vessels, and also to the middle coat of the larger arteries The arteriol's recta in the medulla are early affected, In the advanced stages of the disease the basement membrane of the tubules, the periendothelial connective tissue of the intertubular capillaries, and other strands of supporting fibrous tissue are implicated. The waxy material is homogeneous and translucent when unstained. It appears jellow with transmitted, dark brown, with reflected by hit after treatment with iodine, and gives a rose pink to purple colour, with methyl violet and subsequent differentiation in dilute acid. There is usually a considerable amount of fatty change, catarrh of the tubules, and, in the later stages, overgrowth of fibrous tissue.

- 5 Pigmentary Changes. In permicious anamia the kidney, like the liver and spleen, may be the seat of the deposit of hamosideno. In paundice the kidney is the first organ to be affected and shows a yellow tinge which becomes green on exposure to the air
- 6 Calcification of the kidney substance is rarely observed in old infarcts and chronic tuberculous lesions. It occurs also in the necrosed kidney epithelium in corrosive sublimate poisoning, but this type is demonstrated only on microscopic examination
- 7 Necrosis is an invanal le accompan ment of infarction It also occurs in minute patches in the epithchal cells in corresive sublimate and in canthandes poisoning, also in the bacterial intoxications of diphthena, typhoid, etc., as well as in the auto intoxication of seterus Symmetrical recross of

the greater part of the cortex of the kidney is a rare complication of the puerpenum due to minute multiple thrombi in the small interlobular arteries

INFLAMMATION OF THE KIDNEY OR NEPHRITIS

General Facts—The kidoey is an organ essentially concerned with the elimiation of waste products of metabolism
and poisonous substances. In any condition in which poisons
are circulating in the blood, whether these be of chemical
nature or bacterial origin, the organ is apt to be damaged.
Once this damage has occurred and the eliminating function
of the organ interfered with, matters are made worse, for the
irritating poison accumulates, as do also waste products of
metabolism, which further jouve the delicite secreting tissue.
Thus a vicious circle tends to be set up, which intensifies the
action of the noisonous substance.

Amongst these poisons should be placed the following chemical substances such as alcohol and lead, also bichloride of mercury, uranium ostrate and chromates. Indine also has been found to judge oephnis in animals, and capthandin is a well known irritant of the kidney substance. The toxins of bacteria form a very important group of poisons causing nephritis Organic poisoos such as snake venom, abrio, aod non also are kidoev irritants. Poisons arising within the body itself from no apparent bacterial source may eause nephritis For example, to pregnancy toxins may be generated and give rise to nephritis, and in chronic auto-intoxications, e g gout, the accumulated products of metabolism act detrimentally on the organ. It is chiefly upon the tubular epithelium, and more especially on the convoluted tubules, that these poisons act, although the glomerulus may be damaged in process of their excretion On the other hand, some poisons such as canthandin and certain soake venoms act more specifically

upon the glomeruli, as do some organisms, eg streplococci.

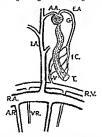
There are two other eliminating channels for waste products in the body—the lungs and the skin. These to a certain small extent are capable of taking on vicariously the function

of the kalney, but only to a very minor extent. This in cases of kalney in additionable beach and the sevent may contribute to the converse also holds good, in that when elimination by the skin is interfered with more work is thrown upon the kalney. Thus, on passing from a warm atmosphere where the kalney. Thus, on passing from a warm atmosphere where the skin is acting freely minor acid one, there is a audden change of the excretory responsibility from the one organ to the other. In addition, the internal organs, among them the kidney, tend suddenly to be flooded with more blood, owing to the contraction of the cutaneous vessels. In this way it is possible to understand the crussion of nephritis through chill. At the same time it must be stated that the general view is that "chill" acts more as a predaposing cause to infections.

The kidney is a very vascular or an and one which is specially dependent upon its blood supply for the integrity of its secreting tissue. Thus any localised disease of the vessels of the organ or any general vascular change implicating the renal vessels will tell detrimentally upon its function, and will produce structural changes of the nature of degeneration in the secreting emthelium with subsequent replacement of this by fibrous tissue. Thus, extensive vascular disease is accompanied inevitably by alterations in the kidney. The converse also holds good. When the Lidney is damaged. products of metabolism are retained within the circulation which irritate and damage the vessels, leading to thickening and degenerative changes. Thus vascular and renal conditions very frequently coexist and, masmuch as the condition of the vessels affects the heart, cardiac disease is eventually super added.

The various supply of the organ is peculiar, and it is well to remember this, as a stifford as means of understanding how structural changes may follow alterations in blood supply. The renal arches which pass between cortex and medally as self-from their cortical aspect branches known as unterlobular, from the moduliary aspect come the articular except which pass down wards into the medulia. The interlobular artenes give off the Arferent attencies which supply the glomerule. The blood levies the glomerulus at the same point as it enters it by the efferent vessels. The glomerulus is a bay of coried capillary.

vessels with a narrow neck, through which the blood enters and leaves the structure. But the blood does not at once return to the veins by the efferent channels. The vessel again breaks up into a series of capillaries (see plan), supplying the kidney tubules with blood. Thus any interference with the flow of blood through the glomerulus will inevitably tell upon the tubules leading to degenerative changes in these. The



Plan of the Circulation in the Kidney

KA, branch of renal artery IA., interlobular artery, AA afferent arteriole, G., glomerulus, EA., efferent arteriole IC., interlobular capillaries T tubule V., venous rootlets, R.V., branch of renal vein, A. arteriar rectie, V.R., venous rootlets.

glomerulus and the related tubules dependent for their blood supply upon the integrity of the glomerulus may be looked upon as a structural kidney uoit, for which the term "nephron" has been suggested. If the glomerulus be thrown out of action by the obliteration of its capillruse, degeneration and collapse of the tubules will occur with subsequent replacement of the nephron by fibrous issue. Conversely, if the tubules degenerate the glomerulus will cease to function. This is one of the reasons why decenerative and inflammatory kidney con

ditions tend to be patchy in type. As a sequel to this patchy disappearance of secreting kidney tissue the healthjer intervening portions, as is the case in other parenchymatous organs. tend to undergo hypertrophy and to project on the surface as rounded nodules between the shrunken areas

A glance at the scheme of vascular supply will show that the first pronounced narrowing of the kidney vessels is in the glomerulus. It is here, therefore, that foreign material such as thrombi and bacterial emboli tend to be strained off Without doubt cerms play an unportant rôle in many forms of nephritis. Their connection with the suppurative forms is obvious, but even in those instances where no macroscopic bacterial lesion such as an abscess develops, minute changes are to be found especially in the glomeruli. Once initiated these tend to progress and ultimately to involve the other structures in the nephron

It is equally clear that disease associated with narrowing of the vessels-arteries or arterioles-will lead to retrograde changes in the parenchymatous tissue of the organ. If some of the larger vascular channels such as the interlobular arteries are affected, the tendency will be to produce large areas of atrophy with consequent deep depressions on the surface of the organ similar to those produced by healed infarctions If the smaller afferent arterioles of the glomeruli are affected the fibrosed areas will be much smaller, and their disappearance will lead to less marked depressions on the surface. All such retro grade changes the consequence of arterial disease tend to be followed by compensatory regenerative changes, just as in the liver in cirrhosis. It may be contended that such con ditions are degenerative, not inflammatory and that therefore the term nephritis is mapplicable. It is, however, customary to place fibrous atrophies due to vascular narrowing among the inflammations, eg as in myocarditis, and there is, of course. no essential difference in the end result the product being scar tissue whether the scar follow on inflammation or on a vascular narrowing

Causation -The causes of nephritis thus are -

1 Chemical poisons, such as corrosive sublimate, cantha ridin, lead, alcohol, snake venom, etc., introduced into the body and excreted by the kidneys, also poisons formed by the body itself, such as abnormal products of metabolism or normal products present in excess, as in the disease called gout.

- 2 Bacteria and their poisons in process of excretion, as in the specific fevers, scarlet fever, typhoid, small pox, etc
- 3 Bacteria multiplying locally, as in suppurative nephritis and tuberculosis
- 4 Circulatory alteration, acute and chronic congestion and embolism

Classification -It is customary and convenient to distinguish two primary groups (1) suppurative nephritis. where perms are actually present and multiplying in the kidney, (2) non suppurative nephritis, that is to say, where the germs, although they may be present, are not multiplying in the organ Sometimes it is merely the toxins of the germs which act upon the Lidney, the germ focus being in some other part of the body, at other times the organisms are in the blood, and damage the kidney while in process of elimination, at other times again there may be minute emboli containing germs derived from the heart valves and caught in the glomerular capillanes But, at any rate, no macroscopic lesion such as an abscess is produced in the non suppurative form The foci of inflammatory reaction, if present at all, are mmute In other cases the disease is due to poisons, and the changes are therefore more of a degenera tive than an inflammatory type This non suppurative type of nephritis corresponds to what is usually called "Bright's disease,' after Richard Bright, the London physician who published his classical work on nephritis in 1827

The present classification of the various forms of Bright's discase is far from satisfactory A perusal of any recognised text book will convince the student of this, and a companison of the classifications in the different books will probably leave him in a honeless condition of confusion. In the

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author's opinion it will tend to simplification if in the first instance the structural changes met with in the organ in nephritis be considered

There are four chief structures composing the kidney tissue (1) the glomerulus, (2) the tubules, (3) the connective-tissue scaffolding or packing, including the capsule of the organ, (4) the vessels—attenes and artenoles. The foundation of the contract of the structure of the contract of the structure of the st

function of these structures and the alterations which they undergo in this form of disease may now be briefly considered. The glomenius is a could system of capillanes arranged in hunches or lobes, covered with a layer of parenchymatous, secreting epithelium and supported by a small amount of connective tissue, the afferent arterole enters, and the efferent vessel leaves, at the narrow neck or stalk by which the glomerulus is attached. The function of the glomerulus is, roughly speaking, to filter through its capillary walls and through its covering epithelium a deproteinised blood plasma. This filtration is brought about chaefly by the pressure of the

blood How far the secretory activity of the epithelial covering is concerned is a debated point. The amount of secretion depends mainly upon the rate of the blood flow, much less upon the pressure of the blood. It has been

recently pointed out that all the glomeruli of the organ do not function at the same time. Some districts are active while others rest. This fact may have significance in relation to the frequent patchy distribution of nephritis. From the point of view of the subject under consideration the glomerulus is of primary importance. The tubules are, as their name indicates, convoluted channels lined by a single layer of epithelial cells varying much in size and general appearance placed upon a connective-tissue bestement membrane and supported by a small amount of stroma. No details need be entered into regarding the function of the tubular channels, suffice to say that it is, generally speaking, to concentrate the fluid received from the

glomerulus so as to preserve water and certain salts for the use of the body

The fibrous stroma is, of course, a mere packing around the parenchymatous elements. The blood supply of the organ is of primary importance. No secretory nerves have been demonstrated in the kidney. It is generally assumed, therefore, that the control of secretion is dependent upon the vascular mechanism. Increased determination of blood to the organ will lead to increased secretion of urine, diminution in the amount of blood reduces secretion. Passive congestion of the kidney also leads to diminution in the amount of urine

Pathological Alterations in the Glomerulus in Nephritis

- Blocking of one or more of the lobules of a glomerulus by a thrombus or an embolus sometimes occurs in the more acute forms of nephritis. In this way a portion of the structure is thrown out of action. It ceases to pulsate with the remaining lobules, and becomes adherent to Bowman's capsule by a process of organisation.
- 2 Hamorrhage may occur into the space between Bowman's capsule and the tuft. The blood may of course be washed onwards and appear in the urine, or it may occupalite, forming a clot which later becomes organized, leading to adhesions which obliterate more or less completely the glomerular space.
- 3 Scelling and proliferation of the endothelial cells lining the glomerular capillaties is a common change in the early stages of acute nephritis. It has been observed specially in "Trench" nephritis by Dunn and McNee
- 4 Leucocytic infiltration of the glomerular tuft and accumulation of leucocytes in the space. This will occur specially in the acute forms associated with the presence of germs.
- 5 Proliferation and shedding of the epithelial cells covering the tuft and those lining the capsule, or catarrh of the space

in which the tubule takes origin. These epithelial cells, in conjunction with connective tissue cells which wander in, lead to the formation of what has been called the "epithelial crescent." A similar result may follow a hiemorrhage into the space, as in (2)

6 Fibrosss mayoccur within the tuft as a seguel to (1) or (3), or it mayoccur around the tuft as a result of (2) or (5), or lastly, it may occur around seapoule as a rosult of merease in the stroma in that situation All these changes, however, lead to very much the same result, namely fibrous atrophy of the glomerulo.

7 Lastly, degenerative changer may occur (a) in relation to the walls of the glomerular capillanes, eg hyaline and its specialised form—anyloid, (b) in relation to attached or shed epithelial cells—cloudy swelling and fatty change

The changes met with in the glomerulus are thus mainly of an inflammatory type, and all tend towards the elimination of this structure as a filtering and secreting mechanism One result of this is that in nephritis the blood pressure of the body tends to rise in order that something like the same amount of water shall be excreted by the kidney Just as when some of the pores of a sieve or filter are blocked, a greater amount of pressure must be exerted to force the same quantity of fluid through Further, owing to the damage to the epithelial and endothelial cell elements, these lose their selective capacity, and in consequence permit the passage of the protein substance in the plasma which ought normally to be retained Hence the albuminum of nephritis Another result of the complete or partial elimination of the glomerulus is that the tubules in connection with it cease to function, and in consequence tend to disappear, the whole "nephron" or glomerulus tubule combination collansing and being replaced by fibrous tissue. This elimination of nephrons may be diffuse or it may be patchy, depending upon the cause of the glomerular damage If, for example, the

damage be due to embolism, as in the nephritis of infective endocarditis, the lesions will be irregularly disseminated and more or less widely separated On the other hand, if the damage to the glomerulus is due to the excretion of toxins or of individual organisms from the blood, as is probably the case in typhoid and in scarlet fever, the damage to glomeruli will tend to be more or less general The importance of this natchy or diffuse change is not realised from the morbid anatomical point of view until the condition has reached its "end stage," namely fibrosis with contraction, the general effect being a shrinkage of the cortex of the organ with a roughening of the surface, which will be coarse or fine according as the elimination of nephrons has been patchy or diffuse The processes of repair and regeneration tend to accentuate this roughening as the more healthy areas of kidney tissue between the scars proliferate, enlarge, and therefore project From the morbid anatomical point of view the early, more acute glomerular changes may produce little that is visible to the unaided eye Swollen glomeruli may be visible as clear spots, and homorrhage in relation to the tuft will appear as petechize These latter may be very striking. The later stages of glomerular change produce by themselves little that can be seen

Pathological Alterations in the Tubules in Nephritis

As the tubules are essentially structures composed of parenchymatous cells, the alterations are mainly of a degenerative type, as follows ---

- 1 Cloudy swelling, associated with swelling, increased granularity, and loss of nuclear staining. This occurs in all cases of acute intoxication, as, for example, by chemical poison or bacterial toxins.
 - 2 Fatty degeneration, commonly a sequel of the above in which, in addition to the other changes, globules of fat like

bodies appear in the protoplasm of the epithelial cells This is characteristic of the more prolonged forms of intoxication, either chemical or organismal

- 3 Catarrh or shedding of the epithelial cells, commonly associated with the above degenerations and accompanied in chronic cases by multipheation of cells A Necasis or death of the epithelial cells, in which they
- lose their structure and staming reactions. This is common in the more severe types of poisoning, as by mercuric chloride. It also occurs more extensively in some cases of eclampsia.
- 5 Calcification occasionally observed as a sequel to necrosis, especially in corrosive sublimate poisoning
- In prolonged catarrh the epithelial cells which remain often exhibit a lower type, being cubical or flattened instead of columnar.
 - 7 Vanous forms of endate may occur into the limen of the thoules, e.g. albuminous or fibrinous material, which forms the basis of the so-called casts, and on which red blood cells, leucocytes, epithelial cells, and crystals may deposit them selves. Such casts, if retained, undergo further degenerative changes, tending to become homogeneous and hyaline.
 - 8 Cystic distention of tubules may occur as the result of hypertrophy and regeneration, or an consequence of obstruction
 - It should be clearly understood that, as Weigert long ago emphasised, one structure such as the tubules cannot be pricked out and attacked whoth the other structures—glomeruli and stroma—suffering. At the same time there are substances (notably the chemical and bacterial pouous) which tend to act selectively upon the tubules, while other factors, chiefly germs, e.g. those of scattlet fever, yellow fever, etc. appear to attack the glomeruli. Damage to the tubules, provided it be not too profound, is much more capable of repair than damage to the glomeruli. Hence tubular nephritis occupies a position by stelf, the term "nephrosis" having

been recently suggested in order to characterise it. The term, however, is not an entirely happy one, and should be used with caution

The poison once removed, repair of epithelium follows, provided always the degenerative changes have not gone too far Where the damage is mainly tubular the reabsorption of water and salts is specially interfered with, hence the resultant polyuma, but it must be remembered that damage to the glomerulus also means damage to the tubules in connection with it. The reverse would not necessarily hold good unless the damage of epithelium is profound.

From the morind anatomical point of view tubular changes result in swelling, particularly of the cortex. They tend to produce pallor and finability in the early stages. If patchy the general effect of tubular changes is a mottling from the presence of opaque, pale, degenerated areas of tubules alternating with the more translucent and normal. In the later stages, when owing to fibrosis there is obstruction to tubules, cystic distention tends to occur, particularly, of course, in the zone immediately subjacent to the capsule

Pathological Alterations in the Stroma

- r Edema or over filling of the tissue spaces with fluid, leading to separation of the connective tissue fibres
- 2 Hamorrhage or escape of red blood cells into the stroma 3 Infiltration of the connective tissue with cells which may
- be (a) polymorphs in the more acute infections, (b) lymphocyte like cells in the subacute and chronic
- 4 Hyaline degeneration in the connective tissue fibres and basement membranes, as in amyloid disease
- 5 Laying down of new connective tissue with subsequent contraction and pressure upon glomeruli and tubules, either following an inflammatory process or as a sequel of the disappearance of parenchymatous units

The general effect of such changes is, in the earlier and

270 DISEASES OF THE KIDNEY AND BLADDER more acute stages, a separation of the individual kidney

elements from one another In consequence, there is swelling of the organ as a whole As soon as contraction of newly formed fibrous tissue asserts itself there will be shrinkage with narrowing of the Lidney substance, of the cortex especially As the changes become more chronic the consistence of the organ becomes firmer the surface roughers with a finer or coarser appearance according to the diffuseness or otherwise of the fibrosis The general colour will be determined by two

factors (1) the amount of blood in the organ depending upon the distention or otherwise of the smaller vessels, (2) the amount of degeneration of parenchymatous cells, the latter change tending invariably to pallot, especially of the cortex This interstitual nephritis in its end or completed form will be much the same whether it has arisen from (1) a primary inflammatory process or (2) by a slow replacement of paren chyma by connective tissue due to some slowly acting poison. or (1) by a similar slow replacement of parenchyma by con nective tissue through malnutation due to narrowing of blood vessels This similarity in end result has led to a great

decree of confusion between the various forms of fibrous or "cirrhotic' kidney This matter will be further discussed below Pathological Alterations in the Vessels in Nephritis In addition to those changes discussed in connection with the glomerulus, chronic disease of the larger vessels-

arterioles and arteries-is a common occurrence in nephritis

The chief changes are (s) thickening of the media due to hypertrophy of the muscle in the first instance, later on this is followed by fibrosis, (2) thickening of the intima, which may be of the nature of a slow, fibrous endartentis obliterans, or may be of the ordinary degenerative type associated with athemma All of these changes lead to a narrowing of the vessel lumen. The results will be somewhat different accord

ing to the size of the vessel affected and the diffusion of the change. It is clear that if a localised narrowing and partial obliteration of lumen occurs in certain of the larger vessels, e.g. the interlobular arteries, the effect will be practically the same as an infarction. Wedge-shaped areas of kidney cortex will slowly disappear, their place being taken by connective tissue. Thus a series of deep depressions will form, more or less widely separated from one another by normal kidney. On the other hand, if the smaller vessels such as the afferent arterioles of the glomeruli are affected, the result will be much the same as if the glomeruli themselves were destroyed. The nephron—glomerulus tubule combination—will be the unit diminated. The fibrosis and consequent contraction will be diffuse, and the surface roughening fine

The matter, however, is not so simple as this, on account of the fact that kidney disease of a chronic type leads to sclerosis and narrowing of vessels as well as results from it. Hence it is a matter of no little difficulty to decide in a given instance which is the primary change—the nephrits or the vascular narrowing. Not infrequently, even with a complete clinical history available, any decision is welling immossible.

From the morbid anatomical point of view it may there fore be stated that arternal disease leads to fibrosis of the organ with a narrowing of the kidney substance and roughening of surface, which is coarser or finer according as larger or smaller vessels are affected. The finer fibrosis is longer practically indistinguishable from the end result of a true nephritis involving glomeruli and tubules, except in so far as traces of antecedent inflammatory lesions of glomeruli and degenerative changes in tubules remain, and can be traced microscopically.

Theoretically we have, as should be evident from the foregoing discussion, two main bases for classification of the nephritis (i) the basis of the structure affected—glomerulus, tubule, interstitual tissue, vessel, (2) the basis

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of the type or stage of the change, se whether acute, subacute, or chrome (3) There is still a third basis for subdivision, and that is the distribution of the change. whether the condition involves the whole cortical substance or whether it is scattered in a patchy fashion through the cortex It must be frankly admitted that from the gross morbid anatomical point of view the differentiation of these types is extraordinarily difficult and often impossible

No classification of the more acute forms of nephritis can he made without the aid of the microscope Further, as already emphasised no strict division can be made from the structural point of view, damage to the glomerulus necessarily meaning tubular change At the same time it is the case that certain poisons select certain structures for their action As regards the degree of acuteness or of chronicity, it must also be acknowledged that no very hard and fast lines can be drawn, and that the acute passes into the subscute and the subacute into the chronic by insensible gradations. At the same time, there are certain kidney appearances found in a nephritis arising rapidly and ending in the acute stage. certain others which can be confidently expected in a case lasting months, certain others again which characterise the cases continuing for years One word more as regards the use of popular terms such as

"large white," ' small white,' and small red ' kidneys They may be, as MacCallum says, "deplorable and often misleading,' but they find favour with the student and the clinician, and they will undoubtedly remain as useful labels

The classification of all types of nephritis is as follows -I Non suppurative Nephritis (Bright's disease)

1 Acute

- (a) Giomerular
- (b) Tubular or catarrhal, often called paren chymatous
- (c) Interstitual

- 2 Subacute (large white kidney)
 - (a) Subacute diffuse
 - (b) Subacute patchy (the type met with in cases of subacute infective endo carditis, and known as focal embolic nephritis)
- 3 Chronic interstitial (granular contracted)
 - (a) Secondarily contracted (small pale kidney), following on more acute changes
 - (b) Primarily contracted (small red kidney), slowly progressive without previous acute stage
 - (c) Arteriosclerotic, due primarily to arterial disease

Amyloid degeneration may occur in connection with 2 (a) or 3 (a)

II Suppurative Nephritis

z Embolic or pyæmic

2 Pyelonephritis (surgical kidney ")

III Specific Nephritis

Tuberculosis

- (a) Embolic (miliary tuberculosis)
 (b) Tuberculous pyelonephrius
- 2 Syphilis

Acute Nephritis

The gross appearances in the various forms of acute nephritis are extraordinarily variable and often far from characteristic. In some cases the organ presents very little by way of alteration from the normal. In other instances, especially where the tubules are pinnegally affected, the appearances are merely those of a well marked cloudy swelling. For this type the term 'nephrous' has been extraodured to indicate that degenerative rather than in

(c) Interstitual Changes — (L) (Edema with separation of the connective tissue fibrils from one another (ii) harmorrhage into the stroma, (iii.) infiltration of the stroma with polymorphs or lymphocyte-like cells, according to the degree of acuteness.

No striking vascular changes are met with at this stage beyond the congestion and hemorrhage.

Changes in the Urine in Acute Nephritis—The amount secreted is diminished. In colour it is often "smoky" to dark red, owing to admixture with blood. On standing it deposits a sediment which contains hyaline epithelial, and blood tube casts, red blood corpuselse, free epithelial cells, and the colour country of the colour colour

Subscute Nephritis-Large White Kidney

Is as a condition which is also often known under the ving names chronic tubular nephritis chronic parenchy Il Sanus nephritis, or chronic glomerular nephritis As, how Listhe changes occupy an intermediate position between , There acute and the more pronouncedly chronic, the term Queute is justified The use of the term chronic tends to elusion with another condition which is quite distinct and " parate, and unquestionably better deserves the term The condition may follow the acute form or it may arise slowly and insidiously. The causes are thus the same in the two types Once degenerative changes have begun in the kidney, products of metabolism are retained. These, accumulating, act themselves as poisons upon the renal cells. Thus a vicious circle is established. It is much more difficult for matters to return to the normal in the case of the kidney once degenerative and inflammatory processes have commenced than it is in the case of any other glandular organ

Naked eye Appearances—The organ is enlarged, although the increase in size may not be very pronounced, all stages being met with It is definitely pale. Hence the term itself, around it and around Bowman's capsule, but the more advanced hyaline stage with disappearance of cells is absent, (iii) degenerative changes, hyaline and amyloid, may be met with

- (b) Tubules These again are mainly of a subacute or more type (1) Fatty degeneration one of the main causes of the pallor of the organ, (n) catarrh and multiplication of the epithelial cells, (in) the appearance of a flatter type of epithelium, i.e. cubical rather than columnar cells in the convoluted thubles
- (c) Intertitual Trius (i) Gedema is a pronounced feature, and one which accounts in some degree for the pallor and increase in size of the organ (n) actual increase in the connective tassue is always present to a greater or less extent. This issue tends to be farrly cellular, showing collections of small round cells here and there. This is occasionally the predominant change. Under these circumstances the term "subacute interstitual nephritis may be employed to characterise the condition. The vessels may show a beginning of the thickening which is so prominent a feature of chronic nephritis. This thickening involves both the inner and middle coats. This is not, however, a constant or characteristic change.

 This is not, however, a constant or characteristic change Amyloid disease is not infrequently associated with subacute nephrits.

Changes in the Urine in Subacute Nephritis —The amount is dimmished. The colour is often pale and hary, but it may be smoky from the presence of Mood. The specific gravity is roto to roso. The total amount of urea excreted is reduced. The amount of chlorides vanes. A large amount of albumin is present, sometimes up to 3 per cent. Blood may be present. The sediment is usually rather abundant and shows many casts of all varneties, fatty granular, epithelial, sometimes blood and l'eucocyte casts, also free epithelial cells, red corpusicles, and isolated feucocyte. As the condition becomes more chrome the unne tends to show the characters found in chronic nephritis.

Chronic Interstitial Nephritis

This condition may follow one or other of the previous types, or it may arise slowly and insidiously as the result of the action of some irritant circulating in the blood-stream Such irritants are alcohol, lead, and products of metabolism which are not being got nd of, as in gou! There is a cery intimate relationship between this type of neighbitis and arterial disease. It is not always possible to decide which condition is the primary one Certainly arterial disease may lead to renal changes such as are found in chronic neighbitis, but just as certainly arterial changes may be the result of renal inadequacy, products of metabolism not being excreted by the kidney, and leading to attendal degeneration. Or again, the two sets of changes may advance pars passus, being due to one and the same cause.

The causes of chronic nephritis may thus be summed up r. The condition may follow acute or subacute nephritis.

and the cause may thus be the same
2 Chronic toxemias alcohol, lead, gout

3 Arterial disease

Instruch as the main change in this condition is a fibrosis or replacement of the kidney tissue by connective tissue, the term "chronic interstitual nephritis" is generally applicable, and on account of the appearance of the organ the term granular contracted kidney" is sometimes used

The essential nature of the process in chronic nephritis, just as in cirrbosis of the liver, is the degener tune and dis appearance of the secreting elements, and the replacement of them by fibrous tissue. This may be brought about by chronically acting poison, but is not infrequently servodary to interference with the blood simply. Thus selecture, changes in a glomerulus will mevitably lead to interference with the nutrition of the trubules around which its efferent vessel breaks up. Similarly endartents in the interlobuling arteries will act by causing malourition of the area supplied.

Naked eye Appearances.—The kidney is always reduced in size, sometimes very markedly so. It may be adherent to the peri renal tusue, and thus present some difficulty in

removal It is, of course, lighter in weight than normal Instead of the normal counces it may weigh 3 or even 2 ounces The surface is more or less rough, and usually shows a varying number of small cysis under the capsule On cutting into it the organ is found to be tougher than usual The cut surface presents great variation in colour in different cases, and the changes are not always uniform, but there are certain fundamental alterations which are commonly present. In the first place the cortex is narrowed, more especially the superficial cortex (Fig 85) In colour, as already stated, the kidney varies. In some cases there is no great alteration, in others, where congestion of vessels is present, the organ is more intensely red than normal, in other cases, again, where tubular changes of an acute or subacute type are superadded to the chronic process the cortex may be pale Sometimes the colour of the organ in general, and of the cortex in particular, is employed as a basis of classification, thus the terms small red and small white kidney are used Such terms are unnecessary A striking point is that there is not the usual difference in colour between cortex and medulla, nor is there the usual line of demarcation. The two seem to pass into one another The larger vessels at the line of junction between cortex and medulla are thickened and project, and the lines of the interlobular arteries passing upwards into the cortex are torinous This irregularity in the vessel markings is very characteristic There is in many cases an increase in the fat around the pelms of the kidney This is due to a shrinkage of the organ away from the pelvis, the place of the kidney tissue being taken by the fat As a result the organ is, if one may use the expression, smaller than it looks from the outside The capsule of the organ is usually more or less thickened and shows abnormal attachment to the surface of the kidney, so that in stripping the capsule, portions of the kidney tissue may be removed with it. In other cases this adherence of the capsule is not marked, but in all eases the surface of the

organ when stripped of the capsule shows more or less trees

organ then stripped of the capsule sheers more or less stregulating (Fig. 86). This roughering may be slight (moreoleather appearance) or it may be very marked. The subcapsular cysts, already mentioned will be obvious on removing the capsular. They contain a clear colouriess fitted.

Under the above description come at least three distinct conditions, distinct, that is, as regards their mode of origin

- r Secondarily Contracted Kidney, that is one in which there is a history of previous nephrini. It is the end stage of the disease. This kidney is more often pale than red owing to the considerable amount of catarrh and degenerative change in the tubules. Microscopically, is shows evidence of glomerul its, is in addition to the fibrosed glomeruli, earlier, more definitely inflammatory changes are present. The changes in general are more diffuse than in the second type.
- s Frimary Chronic Interstitial Nephritis—A condition with a history of rapidly and suddenly developing sensus renal symptoms in an apparently previously healthy person, one where the renal changes have been slowly and insiduously progressing. The kidney is more often red or mutide Microscopically, there is a markedly patchy distribution of the fibrous change alternating with normal or hypertrophed areas. The glomeruls show chiefly the end stage of fibrous atrophy. The tubules show little degenerative change, but the artenes show marked thickening.
- 3 Arterio selective Kidney —There is a considerable amount of confusion about this type. According to some, a fine form of circhoss with minute roughenings of the surface may be produced by disease of the smaller arterioles. The student would be wise to reserve the term for the kidney showing deep, irregularly distributed scarnings. The organ is often red. It may not be greatly reduced in size, but the tendency is for it to be more or less shrunkers. The contrail nurroung it is rirregular in its distribution, depending upon the distribution of the arterial change. The arteries are prominent and

thickened But the roost marked changes are the previously mentioned deep depressions, urregularly scattered and giving the general impression of old marketons. Cysts may also be present, and there may be a finer roughening in addition to the sears.

Microscopic Appearances — A striking fact on examining large sections of such kidneys under the microscope is the ariation in the appearances seen in one part from those seen in another. Areas will be found in which the alterations are slight, alternating with areas in which they are marked. In the early stage of the condition wedge shaped areas of inter-stitual change will be found extending inwards from the cortex. In the more advanced stages this is exaggerated, areas of marked fibrous alternating with areas more or Jess normal in appearance. In other cases the intertitual chaoge is diffuse

"(a) Changes in the Tubules — The epithelium lining the tubules is cubules a rather than columnar, and shows more or less evidence of catarrhal change. In some cases where an account of the consumprises that can be consumprised by the tubules contain by aline or colloid casts. In the more condensed areas the tubules are compressed and narrowed. In the intervening portions of the cortex the tubules are more normal in size or, in many mistances, dilated, and the cells lining them are often enlarged. Sometimes dilated tubules show papilionatous projections into their lumen.

(5) Changu in the Glomeruli — These consist in a fibroud change, all stages of which may be seen. In the earlier stage the capillanes of the structure are still visible although their walls are thickened. In the later stage the glomerulus is reduced to a knot of fibrous tissue, which may show hyaline alteration, and often contains no cells. Again this change shows irregularity in its distribution. It is more marked in the condensed areas, less marked in the intervening portions.

(c) Interstitual Changer.—These consist in an overgrowth from sinsue. In the carthest stage this, as a rule, occurs in wedge shaped areas extending inwards from the capsule. The fibrous tissue is well formed, although accumulations of small round cells may occur. The vessels show more or less

obvious alteration. As a rule this is most marked in the intima, and consists in a thickening, with narrowing of the lumen At the same time the middle and outer coats tend to be thickened. These alterations are seen in vessels of all sizes. Sometimes in cases where the organ has a red appearance the intertubular capillaries are dilated.

In the arterosclerotic type the vascular changes are more

marked, otherwise the appearances are very similar

The overgrowth of fibrous tissue occurs round tubules and glomeruli as well as in the neighbourhood of vessels. Oc. casionally the fibrous change occurs diffusely throughout the organ

Changes in the Urine in Chronic Interstitual Nephritis -The amount tends to be increased. The unine is pale and has a low specific gravity. The amount of urea is diminished. As a rule no blood is present and albumin is scanty, sometimes there is merely a trace. The centrifugalised deposit shows only occasional tube casts. These are chiefly hyaline or granular

Pathological Conditions associated with Nephritis

Cardiae Changes -In acute nephritis degenerative changes may be met with in the heart muscle due to the action of the toxic arent which also causes the nephritis. At any stage of the disease pericarditis and endocarditis may occur as complications The most common alteration in the heart. and one that is specially characteristic of the chronic form of nephritis, is hypertrophy of the left ventricle. This is due largely to the associated arterial sclerosis

Arterial Changes -- These consist in a thickening of the medium sized and smaller vessels which in the earlier stages is probably due largely to a contraction and thickening of the media, in the later stages to a fibrous transformation of the media and to a thickening of the intima of an athero matous type The frequent association of chronic interstitial nephritis with atheroma is well illustrated by a series of 144 cases recorded by Lorram Smith of which 67 6 per cent showed atheroma of one or more groups of vessels. The hypertrophy of the left ventricle and the arterial thickening are both associated with the rise in blood pressure which is so characteristic of the more chrome types of renal disease. In connection with this it may be noted that in cases of cerebral harmorrhage of the variety found in older people some degree of chronic nephritus as well as arterial disease and hypertrophy of the left ventricle may be confidently looked for

Blood Changer — An anamia of the secondary type occurs in all cases of suhacute and in many cases of chronic nephritis Lung Changes — Pneumonia and pleurisy are not un

Lung Changer—Pneumonia and pleurisy are not un common complications of kidney disease (Edema is also common, and is a oot infrequent cause of death

Drophy—Ahnormal accumulation of fluid in the lymphatic spaces and in the serous cavities is very constantly met with in oephritis, both in its acute and in its subacutic manifestations. In chronic interstitial nephritis, so long as the heart does not fail, cedema is not a prominent feature. The exdema of nephritis is probably due to a combination of a number of factors—

- (r) Damage to the endothelial lining of the vessel from the circulation in it of poisonous waste products
 - (2) A watery condition of the blood, due to the anæmia
 - (3) Feeble action of the heart
 - (4) Retention of salt in the tissues

The exdema often shows itself in situations, such as round the eye, where the tissue is loose, but it may spread and involve the whole subcutaneous tissue (anasarca), the serous cavities, and lungs. The exdema of nephrits is relatively soft to the touch. In the later stages of chronic nephrits a dropsy having the distribution and character of cardiac dropsy may appear. It is more connected with the failing heart than with the kideve condution.

Changes in Connection with the Nervous System -In cases

which die with symptoms of urremia, cedema of the brain is commonly present. In all cases albuminume retinities should be looked for. This shows useful in the form of minute hæmorrhages in the retina. As already stated, cerebral hæmorrhage is a frequent cause of death in cases of chronic interstitual nephritis. Of the above mentioned series of 144 cases 55 died of cerebral hæmorrhage.

Tube Casts

These structures, so characteristic of nephritis in all its stages, are casts of the kidney tubules occurring in these or in the urine. In order to examine for their presence the urine should be centrifugalised or allowed to deposit for some hours. A little of the sediment is then removed with a pipette and placed on a slide under the microscope. In order to see the tube casts properly an ordinary high power lens should be used, and the iris diaphragm of the sub-stage should be shut to a considerable extent. The following varieties of tube casts may be distinguished.—

- (1) If Jaline Catts are difficult to see owing to their transparency. They may occur in the acute type of nephritis, being formed of an exudation from the blood. They form the basis for other types of casts such as the cellular variety. In the later subacute or chronic stages transparent casts with a sharper outline are also met with. They are often spoken of as cellural or waxy casts. They are due to changes occurring in shed and long retained epithelium.
- (2) Cellular Casts —These may consist of (a) red blood corpuscles, (b) leucocytes, (c) desquamated epithelium, or of a mixture of these They are characteristically present in the acute and subacute stages of the disease
- (3) Fatty Casts are produced by latty change occurring in cellular casts of the epithelial type. They are most characteristic of subacute nephritis.

- (4) Granular Casts —These are found mainly in subacute and chronic nephrits They are due to changes occurring in cellular casts They may also be produced by the deposit of granules of urates upon by aline casts
 - (5) Crystalline and Pigmentary Casis are occasionally met.

TABLE OF COMPARISON BETWEEN THE VARIOUS TYPES OF BRIGHT'S DISEASE

ccur in	marked hous	Subacute Nephritis or Large White Kidney	Chronic Interstitual Vephr tis or Granular Contracted Kidney
tion to the urmary		Considerable en largement.	Reduction in size, often very small.
cord where there is ly an nor		Firm	Tough
Appearance of cortex	Varies consider adly Often pale as in cloudy swell ing May be congested	Greatly increased in brendth pale and motiled	Always narrowed, colour varies, pale or red
Capsule	Non-adherent.		Thickened and often adherent.
Surface after stripping	Smooth.		Always rough, usu ally with small cysts
Vessels	Not as a rule aftered.		Thickened, cut ends prominent
Penpelvic fat.	* Not altered		Increased
Associated Conditions.	CEdema of bram, other forms of dropsy a inflammatory condu- trons, e.g. pneumonia, pericar ditis, etc.		Arteriotelerosis, hypertrophy of left ventriele, cerebral hæmor shage

Suppurative Nephritis

This is a form of nephritis in which germs themselves are present and are multiplying in the kidney tissue—It is associated with more or less obvious suppurative foci or abscesses

There are clearly two paths by which bacteria may reach the kidney tissue—the blood stream and the ureter. Thus there are two types of suppurative nephritis.

I Hamalogenous Supporative Notes I Promise or Embolic observes of the Kidney—That tubules as provided the third promise of the Kidney—That tubules as provided the pyzmia, ulcerative endocarditis, etc. programs, ulcerative endocarditis, etc. programs, ulcerative endocarditis, etc. programs, ulcerative endocarditis, etc. programs of the sediment is program and under a buscesses rick on a side under or even one group, and the condition include casts propertions on The germs found are those associated and training and ulcerative endocarditis (see pp. 9g. #91. 65)

Naked-ys Appearances—The organ may be slightly enlarged, and is somewhat softer than normal On section, opaque yellow foc are found scattered through cortex and medulia quite irregularly or in groups (Fig. 8-7). These foci vary in size, but are usually munite, and are surrounded by a zone of congestion and hemorrhage. The intervening portions of cortical substance are pale. The capsule strips well and the abscesses are often particularly well seen (Fig. 88) from the outer aspect. Infacts are not infrequently

Minoscopic Afforamers —All the appearances of an acute noephritis are present. There is marked cloudy swelling and catarrhal change in the tubules, and, in the neighbourhood of suppurative foci, actual necrosis. The most striking change however, is an acute interstitial change, the fibrous structures being infiltrated with numbers of cells, chiefly polymorphonuclear leucocytes. This change is intensified in parts so

that the kidney tissue disappears, and its place is taken by a mass of leucocytes—in other words, there is an abs.ess. In the centre of this area masses of germs are not infrequently found, and around the mass of leucocytes a zone of hæmorrhage occurs. The vessels generally are congested. Leucocytes may also be found within the lumen of tibules.

2 Suppurative Pyelonephritis or Surgical Kidrey -In this type the infective agent arrives by way of the ureter It is thus associated with inflammation of the bladder. ureter, and pelvis of the kidney It is usually bilateral, but is often more marked on one side than on the other. It may occur in cases of cystitis due to infection by the passing of a catheter It is thus found in connection with obstruc tion to the unnary passages from stricture or enlarged prostate It not infrequently follows lesions of the spinal cord where there is loss of control of the bladder and the unne dribbles away Organisms readily pass up the tract under these conditions and infect first the bladder, then the wreter, the pelvis of the kidney, and kidney itself. The organisms found are very frequently inhabitants of the lower bowel, thus B cols is very commonly present, also streptococci, siabhylococci, etc

Naked eye Appearances—The organ is often enlarged, soft, and pale. It may, however, be abnormally small from pre-existing chronic nephrits. On section, puts is found in the pelins, which may show thickening, injection of vessels, fibrinous exudation, or hamorthage, but which frequently shows no very obvious alteration. Running up into the medulta are yellow lines representing spread of the suppurative process into the pyramids. In the cortex are similar but more rounded areas (abacesses) with a zone of hemorrhage surrounding them. The intervening portions of cortex are pale. The capsule may or may not strip easily according as chronic interstitual changes are present or not. The abscesses are often well seen from the outer surface.

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Microscopically, the changes are precisely similar to those found in the previous type

Tuberculosis of the Kidney

Two types of tuberculosis of the kidney may be distinguished

A type associated with blood infection, and therefore with miliary tuberculosis of other organs. In this type there are small, scattered white or yellow foci, usually minute, and mainly in the cortex.

Microscopically, these are found to be typical tubercle follicles with giant cells or caseous centres (see p. 174)

a Tuberculous Pyelonephritis or Chronic Tuberculous—
This type may be associated with tuberculous of the lung
or other organs. Not infrequently, however, the Issons, in
the renal tract, are the most striking manifestation of the
disease. The condition of the kidney is very frequently
associated with tuberculous in other parts of the uro-genital
tract, with tuberculosis of testicle, vesiculas seminales, via
deferens, bladder, and ureter. Undoubtedly in some cases
the infection is an ascending one, but in many cases the
bladder may be infected from the kidney.

Noble by Appearance —The appearances vary much according to the stage of the disease. The condition may be limited to one kidney, in most cases it is more advanced in one organ than in the other. The organ may be enlarged and is usually pale. The change begins in the pelvis is most cases, and spreads backwards into the substance of the organ. The pelvis is thus fined with caseous neverthe material, and scattered through the kidney substance are fibro-caseous foce (Fig. 8g). Destruction of the kidney substance proceeds with the formation of cavities or excavations (Fig. 9c). In advanced cases the organ may be transformed into a bag containing structureless caseous material.

The condition is sometimes, in its more acute manifesta tions, difficult to distinguish from suppurative nephritis The foci in tuberculosis tend, however, to be firmer, more yellow, and to stand out more from the surrounding kidney tissue

Microscopically, the changes are those usually associated with the more chronic types of tuberculosis—fibrosis, tubercle follicles and caseous foci.

Syphilis of the Kidney—In some cases of syphilis a diffuse interstitual nephritis may be met with This may or may not be combined with amyloid disease the kidney occasionally occur

Lenkæma of the Kidney—In some cases of leukæma the kidney undergoes little or no alteration. In other cases, more especially in the lymphatic type, the changes may be extreme

In a well marked case of leukamna kidney the organ is enlarged and pale (one type of large white kidney) and through it and under its capsule are scattered numerous hamorihages. The characteristic appearance of the cut surface of the organ is to a great extent lost

Microscopically, there is a marked infiltration of the organ with round eells, lymphocytes, or myelocytes, as the case may be, with a separation of the kidney structures—gloomeruli and tubules—from one another

Areas of mfiltration with red blood corouscles are also met with.

Tumonra

Simple tumours are infrequent, with the exception of small fibromata of the medulla of the kidney, which are very common and appear as small white rounded areas. Adeno mata occasionally occur

Of malignant growths sarcomata are more common than cancers. They are specially frequent in children, and are often of a mixed type containing glandular elements and sometimes strated muscle, cartilage, etc. Such growths are teratoid in nature and are known as blastover/omas.

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FURNADO on you ata or straped muscle tumours of sarcomatous nature are occasionally met with

Hypernephromata are among the commonest type of kidney growth. They are believed by some to arise from suprarenal rests. Such rests are not infrequently found under the capsule of the kidney as small yellow spots. More often they arise from the kidney itself. The hypernephroma vance very much in size and appearance. It usually has opaque yellow areas suggesting the corieve of the suprarenal in appearance, mixed often with hasmorrhagic areas and brownish areas of necrosis (Fig. 92). The tumour is undoubtedly simple in many cases, but in others, where it attains a very large size, tishows malignant characters, and often gives rise to secondary deposits in lungs, bones, and other tissues. Tumours with similar appearances are found arising occasionally in supra renals, liver, and opancess.

Microscopically, the appearances of the hypernephroma vary a good deal, but, as a rule, the cells contain a large mount of fall, myelin, etc., are vacuolated, and generally show some approximation to the appearance of the cells in the cortex of the supersenal

METHOD OF EXAMINING A KIDNEY REMOVED FROM THE BODY

Having removed all adherent fat which, except in cases of chronic interstatial nephrinis, in easily done, note, in the first instance, the size of the organ and its weight. The normal kindery measures about 4½ inches (15 & cm) in length, 2 mehres (5 & cm) in heradth, and t‡ inches (3 & cm) in the high 2 mehres (5 & cm) in heradth, and t‡ inches (3 & cm) in the high 2 mehres (5 & cm) in heradth, and t‡ inches (3 & cm) in the cases in the cases in the cases in the case in

(1) The cortex, its breadth relative to that of the medulla.
This should be as one to three, the cortex measuring about

one fifth of an inch (5 6 mm) in width. Its colour which should be reddish brown, somewhat paler than the medulla. The lines of the vessles running through it for any tortiosity or un usual distinctness from congestion. The glomeruli for unusual romunence and alteration of colour on treatment with odine.

(2) The line between cortex and medulla, which should be fairly distinct, forming a series of arches I no cases of inter stitual nephrits this line is industrict and irregular Note also the appearance of the larger vessels (renal arches) running hetween cortex and medullar.

(3) The medulla for its colour, any opaque lines indicating deposits of urates the presence of small grey nodules—fibromata.
(4) The pelvis for thickening, hæmorthage, calculus or

evudate indicating inflammation.

(5) The perpelvie fat for its relative amount. In the normal organ there is only a very small amount of this. In chronic interstitual nephritis, on the other hand where the has been a more or less marked shrinkage of the organ, it is often creatly increased.

(6) With a pair of dissec mg forceps take hold of the capsule of the organ, ensuring that the whole capsule is grasped by crushing through a small portion of the most superficial cortex with the instrument. Strip the capsule from the cortex, noting the relative ease with which this is done, r e where portions of cortex are removed along with the capsule. Then note the appearance of the outer surface of the organ, whether it is smooth or rough. If rough, whether the roughness is uniform or irregular. Look for sushcapsular cysts, cateatines indicating old infarcts or the more regular trankings of fixtal lobulation. Note Issify the thickness of the capsule.

DISEASES OF THE PELVIS OF THE KIDNEY

Hydronephrosis, or dilatation of the pelvis of the kidney, is due to obstruction to the outflow of the urine. The condition may be hilateral or unilateral.

(1) Bilateral hydronephrosis is due, as a rule, to some obstruction to the passage of unine through the urethra, eg stricture, enlarged prostate, calculus in the bladder. Occasionally it is produced by a large tutnour in the pelvis pressing upon both ureters. The ureters in this type are dilated throughout as well as the pelves

(a) Unlateral hydranephrens is due to some obstruction to the flow of urne through one of the ureters. This may be (a) something blocking the lumen of the ureter, usually a calculus, (b) kinking of the ureter from creatrical changes following injury, with the formation often of one or more S-shaped bends (Fig. 91), (c) a tumour pressing upon the ureter from the outside

As the result of the increased pressure within the polyas, the calyces become distended and the pyzamids flattened Gradually the pressure causes atrophy of the kidney substance, until eventually it may disappear allogether; leaving a fibrous bag containing a fluid which shows only traces of urea and unnary salts. This distention occurs only if the obstruction is incomplete. Complete obstruction to the outflow of urine leads, not to bydronephrosis, but to atrophy of the kidney.

Pyonephrosis is a precisely similar condition to the preceding, in which the fluid in the dilated pelvis is pus. Infection may occur from the bladder of by way of the blood

Pychits, or inflammation of the pelvis of the kidety, may be associated with the irritation due to the presence of a calculus. More often it is caused by an organism such as B adi or one of the progenic occi. Occasionally it may be due to the presence of animal parasites such as filarlie. In the organismal type, infection may come from the bladder or from the kidney.

In many cases there is very little alteration. In well-marked cases there is congestion of the vessels, minute hamorrhages and exudate

The inflammatory process tends to spread to the kidney itself, giving rise to suppurative py elonephrius (surgical kidney). Turbid fluid in the pelvis of the ladney should be examined microscopically in doubtful cases, as phosphates in the unine give an appearance very similar to that of pus.

DISEASES OF THE URINARY BLADDER

Dilatation is due to obstruction or to paralysis of the muscular wall. It may be uniform or localised to certain points with the consequent formation of diverticula

Hypertrophy of the muscular wall of the organ is due to obstruction to the outlet of urne. This may be caused by enlarged prostate, tumour, calculus, stincture of the urethra, or phimosis. The thickening often occurs irregularly with the formation of bands or trabecular. The bladder, in addition to being hypertrophied, is usually also dilated, either uniformly or with the formation of directicula.

Rupture may be due to falls or severe blows when the viscus is distended with unne. The rupture usually takes place on the anterior surface at the trigone. It is followed by extravasation of urine into the pentoneum or into the cellular tissue, and in the latter case by cellulius and gangrene.

Perforation of the bladder may be due to ulceration sometimes caused by calculus or by malignancy, or to the passage of an instrument The opening usually takes place into the pentoneal cavity

Hæmaturia.—The appearance of blood in the urine may be due to nephritis of an acute or subscute type, pyelitis, cystitis, calculus in some part of the urinary tract, tumour of the kidney, pelvis, or bladder, rupture or injury of the bladder, renal tuberculosis, infarction, animal parasitic conditions such as bilharziosis and malana, or to some unknown cause as in essential hamatuna

Inflammation (Cystuts)—Organisms may reach the bladder (1) from the blood, often by way of the kidney, or (2) from without by the ure there. The latter is the commoner path of infection, the organisms being introduced by means of a catheter or finding their own way up in cases where there is incontinence of urine. The commonest germ found in cases of cystuts is B coli, but B protein and core of various types are met with Cystuts may also be associated with inflammation in neighbouring organs, such as the rectum A degree of inflammation is usually present along with calculi, but the calculus may be a sequel of cystus

In slight degrees of the disease there may be merely an increased vascularity of the mucous membrane of the organ, often with minute harmorrhages. In more severe types there is ulceration and in some cases necrosis of the mucous membrane with slouch formation.

The urnse in cystits may be acid when voided, but it tends rapidly to become alkaline. In some cases this change occurs within the bladder. There is usually a copious deposit con sisting, in addition to phosphates, of transitional epithelial cells from the bladder wall, pus cells, and micro-oreanise.

Tuberculosis of the bladder is usually associated with tuberculosis of the kultery. It appears first as small tubercles under the mucous membrane. These are found either grouped thickly round the orifices of the ureters (descending infection) at the trigone and neck of the bladder (ascending infection). Later, ulcration occurs, due to coalessence of the small tubercles and destruction of the mucous membrane As in other types of bladder ulcration, urmary salts are frequently deposited upon the floor of the ulcry salts are frequently deposited upon the floor of the ulcry salts are

Tumours.-The common tumours of the bladder are the villous papilloma and the carcinoma

The former occurs as a soft, friable, " sea anemone " like outgrowth, usually from the base of the bladder Filaments from the growth not infrequently break away and are found along with isolated epithelial cells in the urine Hæmorrhage is very common in such cases. Very frequently these napillomata are multiple

Carcinoma of the bladder is usually of the squamous epithelioma type. It appears as an ulcerated area with raised hard margins

Calculi in the Urinary Tract - These are found in the pelvis of the kidney or in the bladder, also occasionally in process of passing down the ureter or urethra. Stones which originate in the pelvis of the kidney may in this way be found in the bladder Urmary calcult are rarely found in the post mortem room They are usually solitary, but may attain a very large size and may show branching as in the socalled "coralline" calculus of the kidney (Fig 93)

Those which form in the pelvis of the kidney are usually composed of uric acid, prates or exalate of lime, or a combina tion of these with phosphates. Those which arise in the bladder are usually composed of phosphates

By blocking the pelvis of the kidney, calculi not infrequently cause hydronephrosis. The presence of a stone in the bladder leads to hypertrophy of the wall of the viscus and to a degree of cystitis.

Parasites -Bilharria hamatobium is sometimes found in the bladder. The adult worms occur in the vesical veins The ova, which show a characteristic terminal spine, are found in the suhmucosa, where they cause thickenings and papular elevations They also occur in the urine along with red blood corouscles.

CHAPTER XI

DISEASES OF THE BRAIN AND SPINAL CORD AND THEIR MEMBRANES

DISEASES OF THE MEMBRANES OF THE BRAIN

The dura mater forms an anner lining to the cranial bones and it carries the meningeal arteries and veins. In consequence of this, inflammatory conditions of the bones and of the cavities which they enclose such as the middle arthmodal and sphenoidal sissues, are as the middle arthmodal and sphenoidal sissues, are as the six of the dura and to cause thrombus formation in veins such as the lateral sinus, which come into intimate contact with them

In young children the dura mater adheres more closely to the cranial bones than it does in the adult

Hamorthage.—Bleeding may take place between the bones of the skull and dura mater (extradural himorthage), into the dura mater uself (such are infrequent and small owing to the density of the membrane), or between the dura and the ma arachmod (subdural himorthage)

An extradural hamorhage may be of considerable size, and may evert pressure upon the subjacent hrain. It is caused by mjunes to the head and is associated with fracture of the bones of the skull, the blood coming from one of the meningeal vessels, often from the middle meningeal attrict.

Subdural humarhage may be due to upury of the vessels of the duran mater or of the pa arachmod I. may also be caused by the rupture of a diseased vessel, or of an aneurym on a vessel at the base of the brain. Sometimes it is due to a humarhage into the substance of the brain or into the ventricles finding its way to the surface. Occasionally it is due to inflammation of the memogra-either of the dura mater (pachymeninguis hemorrhagica, see below) or of the pia mater in very acute inflammation, as anthrax

Thrombosis —This is not an uncommon occurrence in the venous sinuses of the dura mater. It may be due to wasting diseases such as marasimus in infants, or it may be due to infection. The commonest cause is spread of inflammation from the cavities in the bones at the base of the skull, particularly the middle ear and the mastoid antitum. Such thrombi must be carefully distinguished from post morter clots (see p. 67). Occasionally the thrombi undergo septic softening owing to invasion by germs, with consequent pysemia and metastatic abscesses in the lungs. This is specially common in those forming in relation to disease of the middle ear and masterial antitum.

INFLAMMATION OF THE MEMBRANES OF THE BRAIN (MENINGITIS)

Types

- r Pachymeningitis.
- (1) Acute
 - (2) Chronic.
 - (3) Pachymeningitis hæmorrhagica
- 2 Leptomeningitis
 - (1) Acute, due to various pyogenic organisms
 - (2) Tuberculous
 - (3) Syphilitic
 - (4) Serous

Two main types of this may be distinguished, although the two very frequently occur together (1) Pachymeningitis, or inflammation of the dura mater. (2) Leptomeningitis, or inflammation of the pia arachinoid

1 Pachymeningstis, or inflammation of the dura mater, is usually secondary to supparative inflammation in one of the carties in the bore, such as middle ear and masterd disease, or to a penetrating wound of the skull. It may be accompanied by septic thrombosis in the venous snusses in the neigbbour bood of the indiammatory focus, or by abscess of the brain or leptomeningitis. The membrane is somewhat swollen, the vessels are injected, and there is exidate on the surface. The pia arachnoid may adhere to the affected area.

face The pia arachnoid may adhere to the affected area

Chronic pachymeningins may occur in connection with

fractures or with chronic bone disease A rare condition known as pachymeningitis hamorrhagica is sometimes found in cases of insanity, such as general paralysis and semile dementia and in alcoholism and scurvy On the inner aspect of the dura mater which covers the vertex, as a rule close to the falx cerebrs, laminated blood clot is found Some regard the condition as being merely a hæmorrhage due to rupture of a degenerated vessel, others consider it to be inflammatory Under the latter supposition the primary change is believed to be a fibrinous exudate on the surface of the membrane This becomes organised Some of the young blood vessels in this granulation tissue give way from time to time and so layer upon layer of blood clot is formed. Those who hold the view that the condition is purely hamorrhagic see in the granulation tissue merely an attempt to organise the blood clot

2 Leptomeningitis, or inflammation of the pia arachnoid

This may be due to—

(t) Infection passing from a fractive or a penetraling wound of the skull or from a fractive of the base by way of the ear or note.

(2) Spread of inflammation through the bone from a suppurative focus in middle ear, mastoid antrum, or other space

(3) Infection from the Blood—In cases where organisms are circulating in the blood the germs may settle down in the membranes of the brain, because for some reason these form a favourable site for their growth

As regards the organisms found masimuch as pneumococci in children and streptococci in adults are common causes of middle ear disease, such germs are very frequently found either by themselves or in combination with others Staphylococca and B programus occasionally occur B influence may be met with sometimes as a bacillus or in the form of filaments The Diplococcus intractilularis meningitid fisqual in cases of epidenic exerbor-spinal meningitis (spotted fever) B inhercularis is responsible for a large number of cases Rairer organisms are B anthracis and Streptothrus actinomyces In tuberculous meningitis, and, more rarely, in other forms, infection may be due to spread from diseased vettebre.

Naked eve Abbearances -There is convestion of the menin geal vessels, and vessels normally invisible can be seen. In some cases of rapidly fatal cerebro-spinal meningitis this is all that can be noted After one or two days there is usually more or less exudate This exudate may be fibrinous or puru lent It may be very obvious, yellow and creamy, or thin and meanspicuous. It tends to accumulate in the spaces between arachnoid and pia (Fig o4), more especially in the interpeduncular space and in the sulci along the lines of the vessels The distribution of the change varies in different types In most types, notably in cerebro-spinal meningitis and in the tuberculous type, the condition is most marked at the base, the exudate occurring in the interpeduncular space and spreading up on either side along the Sylvian fissure, also on to the surface of pons, cerebellum and occupital lobes. In other case the change is most marked on the vertex or over the frontal lobes (pneumococcal cases) The convolutions tend to be flattened. There is usually an excess of cerebro-spinal fluid, which is turbed and may be purulent The inflammatory change may extend to the ventricles, and in many cases these spaces show more or less distention with fluid (hydrocephalus)

The membranes of the spinal cord are very constantly affected to a greater or less extent. When this is the case the term cerebro stand membraits may be applied.

Microscopic Appearances —These are similar to those found in inflammations of other serous surfaces. There is dilatation of blood vessels, exudation of fibrimous material on the surface and in the substance of the membranes, and emigration of electrocytes, chiefly of the polymorphonical type. Organisms may be found in suitably staneed specimens. There is usually more or less inslammation of the underlying cerebral substance (encephaltis) as indicated by cellular infiltration around vessels dispuns into the brain substance.

Microscopic examination of the cerebro-spinal fluid obtained during 1/e by lumbar puncture shows polymorphonuclear lenecytes in greater or less abundance, and sometimes reims.

Tuberculous meningitis requires special mention.

Ruserchous mentality a basal and ammation and is usually associated with a similar inflammation and is usually associated with a similar inflammation of the spinal meninges A more or less marked increase of cerebro-spinal fluid it found, which is often fairly clear. In the sub annchmod space at the base of the brain and spreading up the sylvan fisures there may be an opalescent exudate. Sometimes it is conspicuous and creamy, at other times it is difficult to make out at all. The similar vessels appear thickneed, owing to perviscular infiltration, and at the spreading margin, along the vessels of the Sylvan fisure, or upper surface of cerebellum, etc., minute grey or jellow fubercies are found (Fig. 93). Sometimes these are only discovered on stripping the membranes and examining them most carefully by floating them out in water. The ventricles are more or less distended with fluid which may be clear or sightly turbid

Microsophs Apparamete —The cells in the exudate tends to toe of the monounclear type, but on the more acute each polymorphs are often abundant. Here and there especially or count vessels, are folicular aggregations of cells with cells or necrote centers. Tubercle bacill may be numerous, but are often difficult to find.

Microscopic examination of the fluid obtained by lumbar puncture shows cells which tend to be of a mononuclear type, but polymorphs are not infrequently present in considerable numbers. On careful search tubercle bacili are generally to be found, but it is necessary, in most cases, to centrifugalise the fluid, and to make several films from the deposit.

Syphilitic Meningitis—This may be acute associated with an infiltration of the pia-arachnoid with small round cells. It may be accompanied by gummata in the shape of small focu with yellow caseous centres which show a tendency to infiltrate the brain substance. Or it may be chronic, associated with fibrous thickening at the base of the brain and leading to compression of the crainal nerves.

Serous meningitis is a condition comparatively recently recognised which is characterised by congestion and ordema of the meninges with production of a serous and cellular exudate. It is most frequently found in children and is associated with infective diseases, e.g. measles and scarlet ever, in adults it is sometimes found in relation to alcoholism and kidney disease. The appearances are sometimes more marked at the base of the brain, sometimes at the convexity. The causal factor is not always clear.

DISEASES OF THE BRAIN CURCULATORY CHANGES

- r Congestion of the cerebral vessels may be due to active hyperarmia in inflammations such as lepto-meningitis or to chronic venous congestion, the result of valvular disease of the heart
- 2 Anæmia may be part of a general want of blood, as in permicious or other type of anæmia or severe hæmorrhage, or it may be local, due to accumulation of blood elsewhere or to the pressure of a tumour
- 3 Œdema is a common condition which may occur as part of a more general dropsy or may be localised to the

cerebral substance. The causes are these of edema in general, such as renal and heart disease. Alcoholism is a not uncommon cause. Chrome alcoholus not infrequently die, apparently from this cause alone. Climically such eases may simulate, as regards their symptoms, many different types of cerebral lesion,—harmorriage, thrombosis, etc.—and at the post mortem the only brain condution found is edement.

On section the brain in edema has a moist shiny appearance. The grey matter is often rather more obvious than usual from congestion of minute vessels. A small amount of fluid may be squezzed from the cerebral substance, and the ventricles are usualfy distended with fluid.

4 Hydrocephalus, or excess of fluid in the lateral ventricles, may be congenital or acquired

In the congenital form the head may attain an enormous size. The crainal bones are thurned and separated from one another. There is great distention of the lateral ventricles and narrowing of the cerebral substance. The large size of the head leads to difficulty at parturnion. The cause of the condition is obscure, but it is probably mainly due to obstruction to the outflow of fluid from the ventricles into the menuncial spaces.

Acquired hydrocephalus follows sometimes from basal meningitie or tumour formation at the base of the brain It is due to the matting of the meninges and consequent obstruction to lymph flow, following on the inflammatory condition (Tig. 96), or to direct pressure of the neoplasm on the weeks.

Excess of cerebro-spinal fluid in subdural and subarachnoid spaces is met with in a large variety of diseases. It may occur as part of a general octema, it may be due to inflammation of the meninges, or may accompany atrophy of the cerebral substance in chronic alcoholism and in various forms of mental disease.

5 Arterial Obstruction .- This may be due either to thrombosis or embolism Thrombosis is usually secondary to disease of the arterial wall, either atheroma or syphilitic disease (endarteritis obliterans) It also occurs secondary to embolism. It is met with more commonly in the branches of the posterior cerebral and hasilar arteries and in the small superficial cortical branches Embolism is brought about by the impaction of an embolus, usually a portion of a thrombus, in a vessel the lumen of which is too small for its passage. The portion of thrombus may come from (1) a vegetation on the mitral or sortic valve . (2) a thrombus in the auricle or ventricle, (3) a thrombus on a patch of atheroma in the ascending aorta, or (4) from a thrombus in an ancurysm of the ascending aorta or aortic arch (see diagram, p 66) The arteries at the base of the brain are specially apt to be involved. The commonest vessel to be blocked, because it offers the most direct route for the embolus. is the middle cerebral (usually the left) or its branches. Then, in order of frequency, come the posterior cerebral, the vertebral, the anterior cerebral, the cerebellar and basilar a result of the presence of the embolus blocking the vessel. thrombosis occurs to a varying extent

Results of Asternal Obstruction —The cerebral arteries, more especially those branches going to the grangla at the base of the brain, belong to the group of 'end arteries,' te arteries whose collateral anistomosis is not equal to the re-establishment of the curculation after blocking of the vessel Infarction therefore occurs, and the type of infarct which develops is the pale infarct. The reason for this is that, owing to swelling of the nerve elements in the primary stages of degeneration, the return of blood by way of minute collaterials cannot occur or occurs only to a very small extent. In contrast to other organs such as kidney and spleen, where pale infarcts also occur, the necrotic change which takes place results im progressive softening (colliquative necross),

instead of, as in kidney and spleen, cogulation necrosis Such a pale, softened area is often called an area of white softening Sometimes there is a certain amount of return of blood which escapes from the degenerating vessels with resulting numerous small harmorphages (set softening). Later on, as hquefaction proceeds and changes occur in the blood pigment, the area tends to become yellow (yellow softening). Ultimately, removal of the degenerated material occurs with the formation of a cyst, the walls and sometimes the contents of which show yellow pigmentation (Fig. 98)

In the later stages such areas are, of course, easily recogn sed Sometimes, when death occurs rapidly owing to the area involved being large or including somewist entire; the recognition is somewhat difficult. There may be nothing more than a very slight softening of the cerebral substance. This is all cases where arierial obstruction is susfected the consistence of the brain substance should be estimated by carrful pathaton, suspected areas being compared as regards their consistence with the corresponding areas on the other side as well as with surrounding parts of the brain.

Microscopic Appearances - These are the changes usually found in decenerations of the central nervous system -

Ganglion cells show loss of staining of their Nissl bodies and nuclei. The nucleus loss its central position and is eventually extruded. The cell processes become fragmented.

Myelm subtance absorbs water, swells and breaks up into fatty material, which may be demonstrated by fat stains, cholestern, letithin etc. The fat globules are taken up to a certain extent by phagocytes, thus forming granular looking cells sometimes called compound granular corpuscles.

In the later stages the nurrogha and older connective tissue elements prodierate, the young mononuclear cells which are this produced acting as phagocytes for fat, blood corpuscies and blood pigment. The area is invaded by leucocytes, mainly mononuclear, which also act as phagocytes. Harmatodim crystals are often found at the margin of the area, also in the fluid contents of the crysts.

6. Gerebral Hæmorrhage —Although capable of considerable resistance to strain, the arteries of the brain are much thinner walled than those of any other organ or part. More especially are they deficient as regards muscular substance. Moreover, they are less well supported owing to the relative softness of the brain substance. For these reasons, rupture of vessels and consequent hæmorrhage is more common in the brain than in any other organ.

There are two main factors operative in cerebral hæmorrhage—(i) degenerative changes in the vessel wall, (2) increased blood pressure. As regards the degenerative changes, these may be relatively acute as in the vessels of an infarcted area or in the inflammation following septic embolism (e.g. in ulcerative endocarditis), or slowly progressive as in atheroma or syphilitic disease. Not infrequently the vessels, previous to rupture, undergoes localised dislatation with the formation of an aneurysm. Intracated blood pressure is either sudden from strain, or chronic, as met with in cases of generalised thickening of the vessels and in kidney disease, which is so frequently accompanied by chronic vascular disease. Thus the two factors often occur together, and in all cases of cerebral hæmorrhage careful examination of the vascular system and of the kidneys is head be made.

Types

- 1 Small capillary (petechial) hæmorrhages
- 2 Large hamorrhares which may be into
 - (a) Basal gangha sometimes extending into the lateral ventricle
 - (b) Pons Varolu
 - (c) Pia arachnoid on cerebral cortex,
 - (d) Cerebellum
 - (e) Other parts of the brain.
- 3 Hæmorrhage due to laceration of brain

As regards hamorrhage caused by disease, one may distinguish, (1) small capillary hamorrhages, which are found in acute inflammation of the cerebral substance, infective diseases, cerebral softenings, blood diseases such as purpura and pernicious anamia, or in tumours, (2) large, extensive hamorrhages, which are usually due to chronic disease of the vessels, much less frequently due to septic embolism in cases of acute (usually ulcerative) endocarditis, and may occasionally be due to rupture of a vessel in a tumour such as a glioma The first type of cause is met with most commonly in individuals past the prime of life, the second and third types may be met with at any age. It is stated that in something like one third to a half of the cases of the first type the point of actual rupture is a small ancurysm. Some of these ancurysms, more especially those in the vessels at the base of the brain, are easily visible with the naked-eye Others, which are usually in connection with the more minute vessels inside the cerebral substance, are only visible under a low power of the microscope Such aneurysms have been called miliary Some of these miliary aneurysms are in reality false ancurvems

The most common site for cerebral hamorrhage is the region of the basid ganglia (Fig. 97). Something like 25 per cent of cases occur in this position. The vessel which ruptures is usually the lenticules-traite branch of the middle cerebral artery, which supplies the outer segment of the lenticular nucleus and the external capsule. It then perforates the internal capsule and ends in the caudate nucleus. So frequently is this vessel the site of origin of the hamorrhage that it has been called the artery of cerebral themorrhage.

The next most frequent site for hemorrhage is the fows Varolin (12 per cent) (Fig roo). In something like 12 per cent the hemorrhage commences in one of the insperfical testists, 1e one of the cerebral arteries which has not yet penetrated the beam substance. A rare situation for harmorrhage is the excellum and other parts of the cerebrum, such as the frontal bole. When the cause of the harmorrhage

is a septic embolis or one of the hismoorhagic diseases such as purpura, the site may be almost anywhere, e_S the frontal lobe. In the case of a hismoorhage into the hasal ganglia or internal capsule, if there is much tearing up of the brain substance the blood may escape into the lateral ventrities and from there extend under the pia arachnoid. Hismoorhage under the pia mater is also observed when the ruptured vessel is outside the brain substance.

Nahed eye Appearances —On removing the skull cap and reflecting the dura mater, a general flattening of the comroliums is usually observed. Sometimes the flattening is more marked on one side (the side of the hemorrhage) than the other. In the case of hemorrhage into the lateral ventricles, or hemorrhage from one of the larger vessels before it enters the brain substance, or from an aneurys mo of a large vessel, extrawasted blood may be seen in the subarachinid space sometimes extending on to the vertex, but usually more marked at the base of the brain.

On section of the brain, a larger or smaller area of cerebral substance is found form up and the space occupied by blood clot. In older hæmorrhages the clot becomes brownish in colour, and the surrounding tissue is stained vellow.

In all cases of cerebral hamorrhage, as already stated, careful examination should be made of the vascular system—vessels and heart—and of the kidneys. The vessels as a rule show more or less marked arterio-selerosis, the heart shows hypertrophy of the left ventricle and in some rare cases acute endocarditis. The kidneys very constantly show more or less marked chronic interstitual nephritis, which may be of the arterio-selerotic type.

Following on a harmorrhage there is always, if the patient survey, more or less secondary degenerative change in the nerve tracts which have been interrupted. Thus when the hemorrhage occurs into one internal capsule there will be descending degeneration in the direct pyramidal tract of the same side and in the crossed pyramidal tract of the opposite side in the spinal cord

Superficial hamorrhage may also be caused by laceration of the brain substance due to injury If the patient survive some time, red or jellow softening occurs (see p. 304)

Microscopically, there is little to be seen beyond the extravasation of red blood cells. In older hamorrhages there is more or less pigmentation from deposit of hermatoidin in the parts around. There tends also to be an increase of connective tissue (neuropkia and fibrous tissue) around the clot

INFLAMMATION OF THE BRAIN (ENCEPHALITIS)

In the brain substance subjacent to inflamed meninges in the neighbourhood of injuries, blood clots, areas of soften ing, and tumouts there is always more or less marked inflam matory change showing itself in degenerative changes in the ganglion cells and nerve processes, prohieration of neuroglia, infiltration with mononuclear cells particularly around vessels

Types

- Simple encephalitis following injuries, etc (see above)
 Acute non suppurative encephalitis (epidemic en
 - cephalitis or encephalitis lethargica)
 3 Suppurative encephalitis (abscess)
 - 3 Suppurative encephalitis (absces.

 A Tuberculosis
- 5 Syphilis Gumma. General paralysis
- 6 Chronic encephalitis

Epidemie Encephalitis (Encephalitis Lethargica) —This disease, which appears to be a new one, was described first in Austria in 1917 by Economo It is characterised by very variable symptoms. Severe cases often pass into a lethargic state from which they may recover after some weeks. Ocular paralyses are common, also contraction, spasm, and tremor of muscles. The sequelze are many and very various.

The causal organism is as yet unknown, but there is evidence suggesting that it is a filterable virus resembling but not identical with that of poliomychitis

Pathological changes are limited to the brain and its membranes, and are often very inconspicuous In the more acute cases the surface vessels show a striking distention sometimes accompanied by minnte hamorrhages Beyond this there may he nothing visible to the unaided eve Occasion ally there are large hamorrhages The characteristic lesions in the brain itself are often localised in the mid brain, more especially in the following situations, nucleus of the third nerve, substantia mera, red nucleus, but often extending unwards into the basal gangha and downwards into the medulla Cases which die in the acute stage of the disease show an ordema of the cerebral tissue and of the nerves arising from it, minute hamorrhages, filling of the peri vascular lymph space with round cells, and chromatolytic changes in the cells of the nuclei of the cranial nerves the later stages endothelial and neuroglia proliferation occurs with subsequent shrinkage. Pigmentation also takes place following the hamorrhages There is little to note in the meninges beyond the congestion of vessels mentioned above. and there is no constant or characteristic alteration of the cerebro-spinal fluid

General Paralysis—This is a disease found chiefly in males between the ages of thirty and fifty Like locomotor ataxia it is a syphilitic affection, spirochartes being demon strable in the cerebral tissue in suitably stained preparations

If death occurs during the early stage, little more than swelling and congestion of the brain substance is found. In the later, paralytic stages there is found thickening of the membranes of the brain, sometimes also of the calvarium Pachymeninguts hemorrhagica (see p. 298) may be present

There is a reduction in the size of the brain as a whole The pia-arachnoid shows opaque areas and is very ordematous. The convolutions are attrophied, and the enlarged suite contain excess of cerebro spinal fluid which may be tinged yellow. The menunges are often addrenet to the brain.

substance The lateral ventricles are dilated, contain excess of fluid, and the ependyma shows minute granulations

Microscopically, the nerve cells of the cortex and other parts are shrunken and atrophied, and many of them have disappeared. Their processes are wasted and interrupted. There is overgrowth of neuroglas taking the place of the ganglion cells. The vessels are thickened and enveloped in sheaths of mononiclear cells. The cerebro spiral fluid is rich in lymphocytes and plasma cells, and gives a positive Wassermann reaction in high didutions.

Suppurative Encephalitis (Cerebral Abscess) - Two types may be distinguished (1) Pyamic, (2) Solitary

The pyamic type is usually minute, and consuts of numerous abscesses scattered streegularly through the binin substance. There is usually harmorrhage amond the abscesses owing to the vessels damaged by the inflammatory prices giving way.

The solitary abstess is commonly due to extension of inflammation from neighbouring parts, as a rule to middle ear distase (suppurative outs medal) or suppuration in the masterd antisum. Thus the common sites of abstess of the brain are the improve-phenoide labe (fig. 99) and the cerebellum, the two portions of the brain nearest to this suppurative focus. Occasionally such abscesses are due to injuries. The size of the abscesses varies much. It may be the size of a walaut or even a tangerine orange. The wall may be formed of solitened, ragged cerebral tissue, or of a layer of granulation tissue, depending upon the age of the abscess. The contents consist of pure which may be white, yellow, or greenish, and is often very foul smelling. The organisms found are many and various—streptococci, staphylecocci, Buphylecocci, Buponums, etc.

There is a rare and unexplained association between solitary abscess of the brain and pulmonary diseases such as bronchiectasis and empyema.

Microscopically, the appearances are those usually seen abscess formations—accumulations of polymorphonuclear leucocytes with necrotic debris and germs of various kinds Ia the brain substance around are seen himmorphiges, infiltration of the cerebral substance with infilaminatory cell for various types, particularly round the vessels, and degenerative changes in the ganglion cells and other nerve elements

Tuberculosis —Miliary inherculosis, when it occurs in the brain, shows a more marked tendency to affect the meninges than the cerebral substance. In tuberculous meningitis, however, there is always a tendency for the inflammatory change to pass downwards into the brain substance. Occasion ally one meets with multiple exiscess for in the brain substance, but a more common manifestation is the solitary nodule which is found specially in relation to the cerebellum and more commonly in children. Such nodules often act like tumours, producing pressure symphoms.

Exphills, like tuberculosis, when it occurs in the brain, shows a tendency to affect the meninges and vessels. In the latter case, peranteritis and endorteritis are not uncommon Occasionally, gummais are met with, which, like the solitary tubercle nodules, act as tumous formations. Such gummais consist of a caseous centre with surrounding granulation tissue

In addition there is the diffuse form of encephalitis already discussed under general paralysis

Chrome Encephalitis —This may follow injury, softening, harmorninge, or the more acute types of epidemic and suppurative encephalitis. It may also occur in certain forms of instanty, in Huntingdon's chorea, and in the cerebral form of dissemmated selerosis.

CEREBRO SPINAL FLUID IN ENCEPHALITIS AND MENINGITIS

In the lethargic form there is no marked change, although in a few instances the mononuclear cells are increased. In general paralysis (and tabes dorsalis) in addition to the positive Wassermann there is an increase of cells and globulin. The fluid is usually clear and contains an increased amount of globulin in tuberculous meningius. The cell count is increased, the predominant type being the mononuclear. The acute progenic forms of meningius give ruse to turbed cerebro spiral fluid which contains a very large number of polymorphs and a large amount of protein, chiefly globulin. The findings in case of cerebral abscess depend on the antitution of the lession. If the abscess communicates with the meanages a purulent mening this will be set up. A deep-scated abscess may not cause any chance in the fluid.

TUMOURS

The brain substance is formed of (i) nerve cells and their processes, which are epiblastic in origin and price titially never give rise to tumour formations, (2) neuroglia or binding connective tissue of the brain, also epiblastic in origin, which is the source of a majority of the pimary growth of the brain, (3) vessels, endothelium of meninges and ordinary connective tissue, mesoblastic in origin, which may be the origin of sarcomata and angiosarcomata, (4) the ependyma lining the ventricles from which carcinomatous timpours may arise

Tumours of the brain are more common during the first four decades of life, this is due partly to the inclusion of the granulomata in the eategory of cerebral neoplasm, partly to the fact that gluonata tend to occur before middle life, and carcinomate seen as secondary deposits are rare Cerebral tumours are more common in the male than in the female, and they show a more pronounced relationship to trauma than is the case with neoplasms in other parts of the body

Types

A Primary Tumours

- I Gliomata.

 2 Sarcomata, endothel
 iomata, sugiosar
 comata psammo
 mata, etc
- 3 Carcinomata.
 4 Cholesteatomata.
- B Secondary Tumours.
 - (a) Tuberculous nodules. (b) Gummata 2 Sarcomata
- 3 Carcinomata. C Cysts.

Primary Tumours of the Brain.—The commonest of these is the glioma. This may occur in any part of the brain The tumour varies in size, and has a grey, pink, or white appearance, and is not well defined. Sometimes it is translucent, at other times opaque. Harmorrhages frequently occur in it. The tumour may be simple, but often is malignant, and is then called a glio-tarcoma.

Microscopically, the sample type shows branching cells with small round nuclei and long "spider leg" processes which interlace with one another, forming a felted network between the cells. In the malignant types the cells are more numerous, larger, and more urregular, and the intercellular material is correspondingly reduced in amount.

Other forms of sarcomata found in the brain are angiosarcomata, characterised by marked vascularity and tendency to harmorrhage, endoitetiomata, with the sub-vanety paarmomata, which occur mainly in connection with the meninges (see pp 366-67)

As already mentioned, primary carcinomata are occasion ally met in the brain, arising from the ependyma of the ventricles

A curious and rare but interesting tumour is the cholesteatoma (Fig. 101), also known as the "peat" tumour from the mother-of pearl appearance of the surface. It is a solitary tumour, well defined from the brain substance, occurring in connection with the meninges chiefly towards the middle line. On section it is soft and fas a white, laminated appear ance. On microscopic examination it shows layers of what appear to be epithelial cells, with a small amount of subjacent connective tissue and a large amount of laminated dead epithelium Some regard the tumour as arising from the pia mater, and therefore as being an endothelioma, others consider it to be formed of skin epithelium and therefore a terations.

Secondary tumours are relatively common in the brain Both sarcomata and carcinomata are met with The growths may be single and large or numerous and small Secondary carcinomas are usually associated with scirrhous cancer of the breast.

Under this heading may be included the so-called "granulomata" or nodules composed of chronic inflamatory tissue usually with caseous centres, and either tuberculous or syphiatic in origin. In no other part of the body are such nodules regarded as timours. In the brain, however, not only because of their appearance but also on account of the effects which they produce, the term immour may be applied to them. The tuberculous nodule occurs commonly in children, and is found most frequently in the neighbourhood of the cerebellum, vaually on the surface.

Oysts—These may be of the nature of dermords or due to the presence of the cysuc stage of a tapeworm, usually the tenna echinococcus Gysts of the brain also occur following softenings or independent of such. The cerebellium is a common situation for the latter, which are probably congenital Cystic degeneration of gliomata is not infrequent

DISEASES OF THE SPINAL CORD CONGENITAL ABNORMALITIES

Spina Blads—This is a congenital malformation due to incomplete closure of the coverings of the spinal cord, as a rule, in its lower part. Various degrees of the condition are met with from one where the only superficial indication of the presence of an ahnormality is a tuit of hair over the lower lumbar region (ppina bifda occulta) to one where skin in addition to the posterior bonywall of the spinal canal is absent. The common type is one where there is incomplete closure of the bony canal posteriorly associated with a tumour in the lumbar region which may contain meninges only (meningocile), or nerve elements in addition to meninges (meningo-myelocile). Cases of spina bifda, if at all marked, do not live long. Infection occurs sooner or later through the skin and spinal meningitis results.

Syringomyelia is a rare condition of the spinal cord in which there is a timour like overgrowth of the neuroglia (glossis) nor near the centre of the cord. The overgrowth is in a longitudinal direction and is found in the cervical, sometimes in the cervical and dorsal regions of the cord Usually, either throughout the affected part or in some portions of it, there is a cavity in the centre of the area of glossis. This condition of glossis associated with cavitation is known as syningomyelia. The cavity is larger than and distinct from the central canal. The proper nerve structures of the cord are atrophied in consequence of the pressure of this mass of connective tissue. In outward appearance the cord may be unaltered or may be enlarged.

Microscopically, in the affected area tissue consisting entirely of neuroglin is found. In this tissue there is a space or cavity which may or may not be lined with epithehum.

Hydromyelia.—This is a condition corresponding to hydrocephalus, in which there is an over-distention of the central canal with fluid

INFLAMMATION OF THE MEMBRANES OF THE CORD (SPINAL MENINGITIS)

As in the case of the brain, two primary types may he distinguished (r) pachymeningitis or inflammation of the

dura mater; (2) leptomenangus or inflammation of the pun arachinod. It is unnecessary to discuss the causation and the various forms of the condition, as these have already been considered under cerebral meanings. The two conditions are commonly combined, the term cerebro-punal meningsits being employed. Sometimes the inflammatory change commences in the brain and spreads secondarily to the cord; at other times the reverse is the case. In addition to spread from the brain, infection may reach its spinal menings from an inflammatory focus in one of the vertebre, from the blood or from the skin surface in cases of spina brida and bed sores.

INFLAMMATION OF THE CORD (MYELITIS)

Under this heading are included a number of conditions of very various origin. My elitis may be due to the action of irritants and organisms, or it may be due merely to pressure or alterations of circulation. The causes may be classified as follows:

(i) Extension of inflammation from vertebra or meninges:

(a) Organisms and eliquitarione the five blood tream, such as the viruses of tetanus, by drophobia, influence, acute poliomy elitis, etc.

(3) Pressure of alleaned vertebra or lumous (4) Circulatory distributers—thrombours institution, embolism in "Causson" disease. Probably univer this heading may also be included the carse due so. "chill".

also be included the cases due to "chill".

As regards the distributions of the change, the part involved may be mainly the grey matter, when the man policimyellitis has been applied. Or it may be that the white matter is chiefly affected. As a rule, both are implorated. When the whole chameter of a section of cord is affected, the term transverse myellitis is used. If the change is irregulally scattered up and down the cord, the term disseminated is employed.

The morbid anatomy of the condition varies according to

the rapidity of the change and the stage at which its observed of the early stages all types are characterised by a softening of the cord substance. In testing for the presence of the condition, the finger should be gently passed down the cord and any alteration in consistence noted

On section of the cord, in addition to the softening, there may be increased vascularity, which gives a pink appearance to the grey matter more especially Sometimes small hamorrhages are present, and occasionally the cord is so softened that the line of demarcation between grey and white matter is rendered indistint.

The later stages are accompanied by an overgrowth of neuroglue replacing the degenerated nerve elements. This may manifest itself by atrophy and contraction and by the appearance of grey translucent areas with variable distribution, a condition often characterised by the term selection. Degenerative changes occur in the tracts running upwards and downwards from the area or areas involved.

Microscopic changes - These are similar to those found in encephalitis

- (i) Changes in the nerve cells These consist in a disappearance of the Nissl spindles, loss of staining capacity in the nuclei with margination and eventual extrusion
- (ii.) Changes in the processes of the cells—Swelling, bead ing and fragmentation of axis cylinders and other processes. Degenerative changes in the myelin sheath associated with setting free of fat in a demonstrable form.
- (iii) Changes in the neuroglia—Swelling and proliferation of the cells, many of which become free and act as phagocietating up fat globules and appearing as large vacioalized cells (compound granular corpuscies). In the later stages the proliferated glia cells settle down to form more or less extensive areas of globus, replacing the nerve element.
- (iv) Vascular changes—Hæmornhage or thrombosis may he met with. Exudation of fluid and of leutocytes occurs to a greater or less marked extent, depending upon the acutencess of the inflammatory change. A very constant appearance is

a filing of the lymph space which surrounds the vessels of the cord (perovacular lymph space) with cells which may be polymorphonuclear leucocytes, lymphecytes or vacuolated phagocytic cells of uncertain origin, according to the type and the acutieness of the change.

In the areas of secondary degeneration above and below the level of the lesion there is disappearance of the nerve elements—axis cylinders and mychn sheaths—and a replacement of

these by an overgrowth of neurogita.

DISEASES OF THE BRAIN AND SPINAL CORD TO WHICH SPECIAL NAMES ARE GIVEN

There is a number of diseases which affect mainly the spiral cord to which special names are given. Some of these are inflammatory in origin, due to the action of possons upon cells and their processes, others are degenerative. No hard and fast line can be drawn between these two sets of causes, however. No system of classification is attempted, because in many cases the site of the primary change, whether in nerve cell, nerve process or nerve ending, is uncertain. Only the more important conditions are included.

Acute Felicampellits.—This condution was originally known as acute authers polonosylutis and, in its later stages, as infanite brailyins. At first thought to be circulatory in origin, due to blocking of the auterior spinal artery by embolus or thrombus, it is now regarded as originating in nature, due to a specific virus the exact nature of which has not yet been shown. The virus passes through a porcelain filter and is infectious for monkeys. The disease may be epidemic or sporadic. It occurs manyly in young children, usually in the late summer and autumn months. It is associated with more or less marked fever, will later on with the development of paralysis in muscles.

The condition may be met by the pathologist in the

early, acute stage, or in the later stage, when there is atrophy and contracture of limbs

In the early stage the condition has the appearance of a myelitis affecting the whole of the substance of the cord, not merely the grey matter, although the change may be most intense in the latter. As regards distribution the change may be met with in the cervaid or lumbar portions of the cord. Usually there are alterations to be found throughout the cord, sometimes also in the medulla and cerebrum. The site of the most intense change may or may not show softening Sometimes there is a slight degree of inflammation of the meninges. On section of the cord there is usually congestion of the grey matter, and sometimes there are scattered harmor rhages.

Attensespically all the changes described in connection with myelitis may be met with There are degenerative changes in the anterior horn cells, infiltration of the grey matter with cells partly leucocytes more especially lymphocytes, partly multiplied neuropla and connective issue cells Small harmorrhages may be present. Degenerative changes may also be found in the white matter, but the most obvious change is an infiltration of the pervascular lymph sheath of the vessels with cells, chiefly lymphocytes. There is usually a varying amount of infiammatory change in the meninger.

The later sings of the disease is connected pathologically with atrophy of the grey matter, more especially of the anterior horn, sometimes unilateral, at other times hilateral. This shrinkage is associated microscopically with a disappear ance of the nerve elements and overgrowth of neurogia. There is also present a descending degeneration in the motor tracts and nerves.

Progressive Muscular Atrophy (chronic anterior poliomyelitis)—This is a condition which develops in middle life, usually in males Overstrain, injury, exposure to severe cold and infective disease have been put down as causes. It is characterised by a progressive atrophy of the muscles, usually beginning in hand and arm, especially the right hand

The primary pathological change is a degeneration with atrophy in the anterior born cells of the grey matter in the lower cervical region

In the disease known as amyotrophic lateral scleross, which is believed by many to be the same condition, in addition to the degenerative change in the motor cells, there is scleross in the crossed pyramidal tracts

Disseminated or Insular Sclerosis—This is a disease which usually commences in early adult life. Nothing definite is known as regards its culogy, although in some cases an association with acute infective disease has been established. It is characterised denically by (1) a spastic condition of the limbs associated with weakness, (2) tremory.

(3) alterations of speech, (4) nystingmus
As regards the pathological anatomy, the lessons are
usually found in the spinal orod, less frequently in brain,
pons and medulin, and consist in scattered, grey, transparent
areas of seletosis, varying much in size and shape, and having
no relation to any structures or tracts of never.

The patches occur in grey and white matter alike and are sharply defined from the surrounding healthy tissue As a rule, ascending and descending degenerations are absent

Microsopically, in the acteuosed areas the medullary sheath is found to have disappeared entirely, although sometimes the axis cylinder is still present. The place of the degenerated nerve elements has been taken by proliferated neuroglia. Ganglion cells persust for long in discared patthes. In the earlier stages and at the margin of older areas numerous granular cells containing faig lobules are found. The vessels in relation to the patches often show alteration, such as pen and enduternis.

Locomotor Ataxis (Takes Dorsalis).—This disease has a very definite relationship to syphilis It is characterised

chincally hy a peculiar stamping gait, absence of knee jerks, loss of sense of position, Argyll Robertson pupil, optic atrophy, various paralyses, etc

The changes found in fatal cases of the disease are most marked in the spinal cord, which shows a sclerosis of the posterior columns. To the naked eye these columns are translucent and shrunken. There is often thickening of the membranes over the posterior portion of the cord On more careful examination the distribution of the sclerosis is found to vary according to the level examined. In the common variety, where the change commences in the lumbar region, examination of the cord at that level shows degeneration in the postero external column Sometimes, in the more advanced cases, both postero-external and postero-internal are sclerosed. In such cases the upper dorsal and the cervical segments show the degeneration mainly in the posterointernal tract. This is due to the fact that the sensory fibres which run in the posterior columns do so first in the posteroexternal tract and then gradually pass into the posterointernal on their way to the ganglia in the medulla. In cases of cervical tabes, on the other hand, the change is found in the postero external tract in the cervical remon. In combined cervical and lumbar cases the whole of the posterior columns is affected Occasionally other ascending tracts, such as the direct cerebellar and antero lateral ascending are implicated

Microscopically, in the scierosed areas there is found a disappearance more or less complete of the axis cylinders and medullary sheaths and a replacement of these by neurogha.

In addition, degenerative changes are found in the cells of the spinal ganglia in some cases (see changes in nerve cells, p. 317) also in the peripheral portions of the sensory nerves

Thus there is in takes a progressive degenerative change in the sensory neurons of the cord, most marked in the intra medullary fibres of the posterior sensory neuron, followed by a proliferation of the n-uroglia As regards the primary change there is great uncertainty and considerable difference of opinion. Some regard it as being the selerosis of the postenor columns, others a local meningists implicating the postenor roots as they pass through the meninges and to cutting them off from their trophic centres. Others again say that the degeneration of the cells in the postenor root gangloon is the first lesson.

Hereditary Spinal Ataxia (*Predreich's Alaxia)—This is a disease which usually affects several members of the same family. The lesson in the spinal cord is similar to that found in locomotor ataxia but in addition to the selectors of the posterior columns there is a similar change in the lateral parts of the cord affecting the crossed pyramidal tracts, sometimes also the direct cerebellar and anterolateral ascending tracts.

Huntingdon's Chorea.—Huntingdon's chorea may be defended as an herederlary form of the disease bearing no relation to so-called rheumatic chorea. It is often traced through several generations, and affects both seves equally The symptoms usually begin about middle life and coinst of choreic movements and attay with progressive mental enfelblement.

The disease is apparently a ghous, roore especially of certain portions of the central nervous 53 stem, but a general diminution in suze of brain and cord is usually to be noted. The parts of the brain which are specially implicated are the convolutions of the purferiontal and motor areas, the putamen and neighbouring basal ganglia.

There is an increase in the cerebro-spirit fluid (external hydrocephalus). The meanings may be thickneed, but this is by no means constantly found, and pachymeningnia hemorrhagica may be present. Careful examination of the grey matter of the convolutions of the perforntal and motor areas shows a narrowing of these. There is atrophy of the

grey matter of the basal gangha, particularly of the putamen portion of the lenticular nucleus. This shrinkage leads to a dilatation of the lateral ventricles with passive increase of fluid, or internal hydrocephalus.

Microscopically, the change in the motor cortex can only properly be appreciated if section stamed on the one hand to show the nerve cells and their peocesses, on the other the neurogial, are compared carefully with normal preparations from the same regions. When this is done it will be found that the third layer of pyramidals, shows more or less marked diminution in its ganghouse elements. The cells which remain show a thinning of the layer of pertoplasm round the nucleus. The protoplasm stains a uniform dark colour and exhibits no finer structure at all In other words, the Nisal bodies have lost their outline and definition and the whole cell is atrophied. The nuclei stain deathy that are ill-defined.

The dentries of the cells are shrunken and corkscrew like. Concident with this change in the ganglion cells is an increase in the neurogia cells. An unstruned margin is visible round the nuclei of these cells, indicating a vacuolated protoplasm. This change is visible in a more or less marked degree throughout the motor cortex, but it is in the third or ggantopramidals layer that the most pronounced alteration is to be observed. The vessels of the cortex generally are thickened especially as regards the adventura, and pigment, the result of accumulation of products of degeneration in the perivascular jumphatics, is to be seen

Similar changes, sometimes accompanied by small bæmor rhages and pigmentation, are found in the basal ganglia, notably in the putamen

Progressive Lenticular Degeneration (Wilcon's Dassas)
—This sanother of those rare and interesting affections of
the central nerrous system which run in families. It has a
curious and constant relationship to a form of common
cirrhous of the liver. It is a disease of adolescence, and the
cause and nature of the condition are unknown.

The change found after death in the central nervous system is a symmetrical degeneration of the lenticular nuclei with secondary degeneration in the tracts passing from them. The putamen and the globus pallidus are the structures chiefly affected. These may show all degrees of disintegra tion from a worm eaten appearance to complete cavitation, as in cerebral softening. As strated, the liver shows a coarse form of common erriphosis.

Microscopically, there are found degenerative changes in the gaughon cells, which disnitegrate and disappear. The remaining cells are airrophied and stain deeply. The myelin sheaths of the fibres are broken up and there are pumerous compound granular corpuscies filled with fix globules. At the same time there is an overgrowth of neuroglia and a hyaline degeneration of the vessel walls.

Temours

Tumours of the cord or its membranes are rare. Apart from tubercle nodules and gummats, the commonest growth is the ghoma, next comes the sarcoma. Secondary growths, both sarcomata and carcinomata, are occasionally met with

More common are tumours in the vertebrae-sarcomata and carcinomata-pressing upon the cord and leading to michitis

DISEASES OF THE PERIPHERAL NERVES

Neuritis, or inflammation of the nerves, may be due to (1) bacterial poisons such as in diphtheria, (2) chemical poisons such as alcohol, arsenic, lead, and goot, (3) trauma, (4) extension of inflammation from adjacent parts.

It is customary to distinguish two types (a) parenchymatous neurits, in which the degenerative change in the axis cylinders and medullary sheath is the main thing, (b) interstital

neurits, in which the overgrowth of the fibrous tissue elements of the nerve is the chief process. There is in reality no hard and fast line between the two types. When the poisson is, as in diphtheria, rapid in its action, the degenerative change predominates, when the poisson is, like tuberculosis or leprosy, slow in its effect, the interstitual process is in the ascendant.

In the more acute cases, beyond some swelling and increased vascularity of the nerve, there is little to be seen with the naked eye. In the more chronic types, nodules of granulation tissue and fibrous thickening are met with.

Microscopically, specimens treated with osmic acid will show black colouration of the myelin sheath. There is infilitation of the connective tissue with inflammatory cells, more marked in the chronic cases.

Tumours — The commonest growth as the fibroma (so called neuro-fibroma). Such tumours are often multiple. They called neuro-fibroma? Such tumours are often multiple. They called sets, also sometimes in the internal organs such as heart stomach, and intestines. This diffuse form of neuro-fibroma tosts is often known as Recklinghausens a disease of fibroma molluscum. Occasionally the nodules undergo a sarcomatous change.

CHAPTER XII

DISEASES OF BONES AND JOINTS

DISEASES OF BONES

RICKETS

Titts is essentially a disease of infancy, although the results of it tend to persist throughout life. The underlying factor in its production is a deficiency of calcareous material in the newly formed bone.

The causation of the disease is still obscure, but deficient amount of lime salts in the food or failure to make use of the lime salts already present is, in all probability, the explanation of the relative absence of these salts in the bones. Some ascribe the conducto to defective action of ductless glands, which produce an internal secretion, such as the pituitary and survariant.

The changes found in the body in cases of rickets are as follows —

t Enlargement of the head with prominer ce of the protuberances of the skull and thunning of the remainder of the bony walls (cranotales) The fontanelles remain open for an unusually long period

2 Enlargement of the epiphyses of the long bones and of the costo chondral junctions The latter condition results in the formation of a double row of nodules, the so-called 326 "nekety rosary" (Fig ros) On section of one of these nodules the line of junction between bone and cartilage, which should be more or less straight, is very irregular and vascular

3 Deformation of the bony shelton as a result of the softening associated with the absence of lime salts

(a) Prominence of the sternum

(b) Curvature of the spine (kyphosis and scolidsis)

(c) Curvature (occasionally fracture) of the long bones such as the femur Sometimes consequent on the bending, a new formation of bone takes place along the concavity of the tibia or femur (buttressing)

(4) Narrowing of the pelvis antero posteriorly, resulting in difficulty during particular. Also throwing out of the like bones

In addition, there is often abnormal prominence of the abdomen, and dentition is usually delayed.

Microscopically there is found at the epiphyses of the bones and at the costo-chondral junctions (a) a broadening of the rone where the cartilage cells are undergoing multiplication, at the same time there is irregularity in the arrangement of the cartilage cells.

(b) Irregular calcification of the cartilage

(c) Penetration of blood vessels into the cartilage

(d) Formation of a spongy osteoid tissue with deposition of lime salts which can be demonstrated as granulst material, rather than a combination of the lime salts with connective tissue to form true hone.

At the same time there is a laying down of a layer of vascular tissue under the periosteum which later undergoes ossification.

OSTEOMALACIA

This is a rare disease, found especially in certain localities, e.g. the Rhine Valley and Flanders. It is more frequent in females and has a definite relationship to pregnancy

It is stated to have been cured by the removal of the

The condition is essentially a decalenfeation of the bony trabeculer, beginning at the surface of the bones, with, at the same time, a tendency to the formation of new bone which remains imperfectly calenfed. As the result of the process of softening and under the influence of pressure, the bones become deformed and sometimes fractured.

The pelvic bones, owing to the great pressure to which they are subjected, are usually the most deformed, with the result that there is a crumpling of the bony, will of the pelvis, so that the cavity is greatly narrowed. Other bones, such as the vertebre, clavicles, and femur, undergo a similar process of bending.

INFLAMMATION OF BONE

The inflammatory process as it occurs in relation to bone shows certain peculianties due in great measure to the physical characters of the tissue and to the anatomical arrangement of its constituents

From the point of view of inflammation, three different parts of a bone may be distinguished-(1) the feriosteum, a vascular connective tissue structure which covers the exterior of the bone and from which the nourishing vessels enter the bone. When the periosteum is stripped from the underlying bone, as it may he artificially or by the accumulation of exudate, the more superficial parts of that bone tend to undergo necrosis Further, the periosteum has the capacity of forming new bone, and under the influence of chronically acting poisons this function is stimulated (2) The bone strelf is a ngid non-expansible tessue, dependent for its nourish ment upon the vessels which pass into it from perios'eum and medulla. When it is the scat of the more acute types of inflammation, the exudate from the vessels, unable to infil trate the rigid tissue around, accumulates and presses upon the vessels, thus leading to necrosis of the bone. In the less acute types of inflammation, probably in order that there

may be space for the inflammatory reaction, the hard resisting bone is excavated by means of large cells (osteoclasts). This rarefaction of the bone is known variously as osteo-porosis or caries. (3) The medulla or bone marrow, also a vascular tissue, having as its function the nounshiment of the bone and also the formation and destruction of blood

When inflammation attacks bones the process usually commences in one or other of the vascular structures—perosteum or medulla, by far most commonly in the latter As the process extends, it tends to involve the other structures, so that periositiis usually accompanies osteomyelitis and vice terms.

As the inflammatory conditions of bone are more common in childhood, the relationship of the primary focus to the epiphysis is important. The infection takes place usually in that portion of the diaphysis which abuts upon the epiphyseal cartiage. This is the point where the growth of bone is most active and where blood vessely are most numerous.

The causation of the inflammatory process may be (1) injury, (2) organisms such as the progenic cocci, B typhosus, B tuberculosis, the organism of syphilis, etc.

Three processes are found going on, often side by side, in inflammation of bone (1) Necrosis or death of bone, (2) New formation of lone which is often hard (sclerosis) but may be porous, (3) Rarefaction of the pre-existing or newly formed bone (osteo porous or caree). In the case of the more acutely acting strutants the necrotic process tends to predominate, owing to the tendency for exudate to accumulate and to obliterate vessels and separate personeum. In the case of the more chronically acting possons—prolonged ecocal infection, tuberculosis and syphilis—the rarefying process is met with along with new formation of bone. This laying down of new bone is merely a modification of fibrois or interstitial inflammation due to the fact that the new connective tissue contains lone forming elements.

DISEASES OF BONES AND JOINTS

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Acute Osteomyelitia.-This condition sometimes occurs during the course of specific fevers, but often occurs spontane-ously Young children are particularly susceptible Sometimes there is a history of an injury to the bone, at other times the disease arises without any such predisposing cause The condition is an organismal one, staphylococcus progenes aureus being very commonly present, but other staphylococa, streptococci, and B tythosus are occasionally found. The organisms reach the bone marrow by way of the blood stream, having been absorbed from the throat or intestinal tract or other focus of infection. They deposit themselves in the vascular, growing area of the diaphysis which is in immediate contact with the epiphyseal cartilage. The area of marrow involved shows congestion of its vessels, purulent infiltration, and hamorrhages Sometimes localised areas of suppuration (abscesses) develop in the bone From the medulla the inflammatory process passes by way of the Haversian canals to the penosteum, where pus accumulates, raising the membrane from the underlying bone. In this way necrosis, more or less extensive, may occur in the shaft of the bone with formation of sequestra. Sometimes the coinbyses and joints are involved Reaction of the bone-forming tissue begins after the acute stage is over and the pus has been evacuated or has found its way to the surface. An involucrum or envelope of new bone forms around the original shaft, and if the infection persist the chronic stage of the process ensues

Owing to the occurrence of thrombosis in the veins in the neighbourhood and subsequent infective softening of the thrombi, measurative obscurses and reptix inflared may form in other parts and organs, especially in the lungs, Pencarditis is not an uncommon accompaniement of acute osteomichias, the infection being carried by the blood

The bones most frequently affected are the femur, tibia, and humerus, the order of frequency, according to Fraser.

being as follows upper end of thus, lower end of femur, lower end of this, upper end of fumerus Other bones may be the seat of the change by extension of inflammation from neighbouring parts, $e_{\mathcal{E}}$ the bones of the skull or finger in cases of septic wounds Rarley the vertebre may be affected

Chronic Osteomyelitis —Healing of the inflamed focus may occur spontaneously, or, as is most usually the case, the diseased area may be removed by the surgeon, and healing result. At other times the inflammatory change persists Organisms remain in portions of dead bone (sequestra), and the irritation is kept up. From such foci a purillent discharge is constantly flowing, which finds its way to the surface by openings in the bone (doace) and sinuses in the soft parts. At the same time the periosteum, kept in a constant state of proliferation, forms new bone which may enclose the sequestra or dead areas, forming what is called a "new case". This new bone usually has a spongy character but may be dense (Fig. 166)

Waxy disease is not infrequently found in relation to chronic suppurative conditions of bone

Taberenious of Bone—Taberculous disease of bones is met with more especially in young children, $r \in m$ growing bones, although the results of such disease are often seen in the adult. A large percentage of cases are due to infection with the bowne type of the tubercle bacallus. The organism may reach the bone by the blood stream or by the lymphatics. In the latter instance the primary focus is usually the synovial membrane of a neighborung joint. The bones most frequently involved are the vertebra (Fig. 107), femora, the tarsal and earnal bones, and the ribs

The condition may begin in the interior of the bone, usually in the cancellous tissue at the ends (in the case of the long bones) or, much less frequently, in the periosteum It appears first as a grey translucent area surrounded by a

vascular zone. This area spreads, gradually absorbing the bone, and so producing tarefaction or canes. At the same time, o ving to the initiation of the focus new hone may be lad down in the neighbourhood, particularly under the periosteur. In ripadly progressive cases, largely owing to obliterative changes in the vessels but also due to the action of the tubercle poison necross of larger or smaller areas of bone occurs with formation of sequestra.

The change may spread to the surrounding parts and a tuberculous (so-called odd 7 abscess develop in the tussues. This is particularly the case in tuberculous of the vertebre, retropharyngeal abscess occurring in connection with cervical ducate, proto abscess in relation to limbar discusse (FG 197). Sometimes the focus infects the spinal cord, setting up a meniancitis.

Deformity of bone frequently follows tuberculous disease. This is more especially seen in tuberculous of the spine.

Eyphilis of Bone -Bone may be the seat of disease both in concentral and acquired syphilis

In congenital symbils the disease shows uself chiefly at the ends of the long bones in it e part where conficction is taking place (symbiline epithinin). The line of callofication is broader and more irregular than normal. The result of this is an interference with growth leading to a form of dwarfing

In the acquired form of the disease the lesion is essentially gummatous. Such gummata may occur in the penosteum or in the medulla of the bone. The process may be found in any part of the skeleton, but it is commonest in the tibra, ulting, sternum and culvarum. Undermeath the Fuhum attere is eroson of the bone which has, in the case of the calvarum, a characteristic curvolus appearance (comma renors)

Sometimes thickenings occur in the bones (long and flat) leading to the formation of raised areas (syphilistic nodes). The newly formed bone is in these cases very dense Osteitis Deformans (Paget's disease of bone) -This is a rare disease of advanced life

There is a general thickening of such bones are at the same clavicles, skull, and vertebre. The bones are at the same time spongy and relatively light, although the medullary cavity is narrowed from the formation of new home. Owing to the softness of the bones deformity occurs, particularly in bones, such as the lower extremities, spine and clavicles, which are subjected to pressure

Acromegaly, a condition caused by disease of the pituitary gland, is associated with an enlargement of certain bones, e.g. the lower jaw, hones of the face, hands and feet. The enlargement is due to a laying down of new bone as well as to a thick-ming of the perconstrum

Tumours of Bone - Of simple tumours, osteomata, chondromata, and fibromata are met with

Of malignant growths, sarcomata of various kinds occur primarily—osteo-sarcomata (Fig. 108), chondro-sarcomata, myeloid sarcomata (Fig. 100), and myelomata

Secondary deposits of carcinoma are occasionally met, particularly in carcinoma of the breast and prostate

DISEASES OF JOINTS

INFLAMMATION (ARTHRITIS)

Acute Arthritis

I Non suppurative—This is found following injury and in connection with acute rheumatism. The joints most frequently affected are the knee, shoulder, and ankle. Several joints are usually attacked at one time. The inflammation is in the tissues around as well as in the joints themselves. The latter show swelling of the synovial membrane and the presence of a thin yellowish fluid which contains usually

relatively few leucocytes although pus occasionally forms From the inflamed synovial membrane (not from the flu d as a rule) micrococcus rheumaticus can in some cases be cultivated

2 Supparative Arthritis —This may occur in the course of a pyramia the organisms being conveyed by the blood, or infection may take place directly, due to a penetrating wound or inflammation in bone or neighbouring tissues. The germs found are the progenic cocci, more especially interfaces; and generosci.

The synovial membrane is swollen and its vessels injected. The joint contains more or less purulent fluid, often ruxed with blood. In the more severe forms, particularly the ronococcal, there is destruction of the cartilaces of the bones.

Tuberculous Disease —Tuberculosis may commence in the synovial membrane of the joint or it may spread from the adjacent bone

In a well marked case of joint disease there is a general pallor of the tissues in the neighbourhood. There is some increase of synovial fluid which is serofishnous and occas on ally purifient. The synovial membrane is thickened, sometimes with the formation of finges. The earlings is eroded through the invasion of granulation tissue from the margint of the bones. There may be carined or sequestrum formation in the exposed bone. In advanced cases the tendons and ligaments in connection with the joint are infiltrated with tuberful. The joints most commonly affected are high, lines, clows and ankle. The condution may heal, with the result that ankylosis frequently occurs.

Rheumateid Arthritis, —Thus us a duccase which is found most frequently in females. The small joints of the hands and feet are usually first affected. Later on those of the elbow and knee are involved. The joints show a fix-form swelling and contain access of clear synovial fluid. The synovial membrane is swollen and congested, and even in the early states, there may be some fibrillation and destroes.

tion of cartilage The condition is not often found in the post mortem room in the early stage

In the later stages of the disease, erosion of cartilage with bournation or polishing of the bone laid bare, also new formation of bone at the margins of the joint (hipping), are character istically present. At the same time there is marked deformity as well as restriction of movement, due both to the hipping of the bones and to the formation of fibrous tissue between them

Gout —This condition should be looked for specially in the metatarsophilangeal joint of the great toe. It shows itself by deposits of opaque white material (salts of inne and) in the cartilage and in advanced cases in ligaments and soft tissues. There is chronic inflammation in the tissues around

Charcota Disease of Joints—This is a mrc condition, found sometimes in individuals suffering from locomotor atawa and syringomyelia. There is a great enlargement of the joint due to the accumulation of fluid unit, also increased mobility. There is later destruction of the cartilage, bonts and ligaments, the condition being, however, painless. The synovial membrane is thickened, and may show villous cutrowiths.

CHAPTER XIII

DISEASES OF THE REPRODUCTIVE ORGANS AND MANMARY GLAND-DISEASES OF PREGNANCY

DISEASES OF THE OVARIES

The appearances of the ovary in menstructing women should be carefully differentiated from those seen in disease

The organ is swellen and vascular, and hymorrhagic areas occur in it. Occasionally severe hymorrhage may occur into the peritonical cavity. Similarly corpora lates, with their yellow colour and characteristic wavy outline, should be distinguished from tumours.

In acute inflammations of the personeum the ovaries and tubes participate in the influmnatory condition and often show marked vascularity. This should not be mistrike, for evidence of primary inflammation in these organs. In old age the organs undergo atrophy. The capsule becomes thickened and shows life.

Tumours —The overy is one of the organs in which tumours are exceedingly common. As a rule such turnours are cystic.

Single cysts occasionally occur from dilatation of a Granian follicle. Solitary cysts also develop sometimes from the parovanum.

Compound Cystic Adenora -This is a common tumour which may attain an enormous size. It consists of a number

of rounded or urregularly shaped spaces enclosing a translucent or transparent gelatinous or semi-solid material containing various mucinous constituents. Not infrequently small papillomatous ingrowths are found within the cysts which divide and subdivide. When such are present the term papilliferous cystadenoma is applied Such a tumour, like the similar one found in the breast may undergo a malignant transformation When these cystic tumours of the ovary funture they sometimes give rise to the formation of immense numbers of secondary growths scattered through the pen

For microscopic appearances see pp 359, 360

Dermond Cysts (Teratomata) -The ovary is the commonest site for this type of tumour. They wary much in size They are recognised by the soany looking contents mixed with hair and containing often teeth, cartilage, bone, etc. (Fig 102)

Fibromata occasionally occur in the ovary, also fibrosarcomaia which may attain a large size

DISEASES OF THE FALLOPIAN TUBES

Salpingitis -Two types of this condition are met with. viz conococcal and tuberculous In the former the tubes are thickened and dilated, and contain creamy or cheesylooking bus, which in many cases is found to be sterile

In the fuberculous type there is a similar dilatation, thicken ing and tortuosity Minute grey tubercles may be visible in the walls, the contents are often caseous. These two conditions are sometimes to be differentiated only on micro sconic examination

Both give rise to localised pentonitis with adhesions, and both may be the starting point of a generalised inflammation of the pentoneum

The Fallopian tube is the commonest site for the occur 22

tence of ectopic gestation. Death occurs from rupture and hamorrhage into the perstoneal cavity

DISEASES OF THE UTERUS

The size of the uterus should in all cases be measured and its cavity investigated for developing ovum or factus

Thrombosis in the uterine voins is a constant occurrence after particular Occasionally portions of such thrombi are carried away, and produce (at al pulmonary embolism

Sometimes, after operations on the uterus or ovaries, a similar accident may occur in such cases the emboli may originate from vessels in the neighbourhood of the removed growth or organ or from the abdominal wound

Acute Endometritis.—This condition is a not uncommon cause of death in purpersal cases. The disease is an infective one, due as a rule to a streptoceascu. A grain negative coccus not unlike the gonococcus has been recently described as occurrance in the uterus in such cases.

The organ is of course enlarged. The internor has a grey appearance, owing to the presence of septic sloughs in the wall. There is usually a food door. Flims from the soft incroise interior show immense aumbers of organisms, among them streptacen. The uterine views are filled with through, which may be undergoing septic softening. Septic infarcts are not uncommonly present in the burgs.

Organs such as liver, kidneys and heart show extreme cloudy swelling. Acute pentonuts localised to the neighbour hood of the uterus or generalised throughout the peritoneum may be present.

Microscopically, the innerriost portron of the uterice wa'l shows necross. Numerous germs of various kieds are present. Further from the lumen the u error muscle is infl rated with inflammatory cells, and thrombs are found in the versels, in

this position in suitably stained specimens streptococit are usually the only organisms seen

Chronic Endometritis — Two types of this condition are commonly distinguished: (x) glandular endometritis, (2) interstitial endometritis

1. Glandular endometrits is also called glandular byperplana. It is questionable whether this condition is in reality an inflammatory one. There is little or no evidence of inflammation from the intersection point of view. The main change is a hyperplana of the gland elements of the endometrium. It probably represents the persistence of a stage in the mentitual cycle.

The uterus is enlarged and its mucous membrane thick ened, vascular and spongy Polypoid outgrowths may be associated

Microscopic Apparametes —Sections of the uterms wall show gland acm more or less regularly arranged, but often torous and sometimes dilated, between which is a deheate stroma of connective tissue. The gland acm may often be seen pene trating the muscular wall for some distance, so that the condition may be confused with an adeno carcinoma of the uterine wall. The gland cells are, honever, only a single layer in thickness, and are arranged regularly upon a basement mem transe, although there is sometimes shedding of the cells

Sections of curettings from a case of this kind present a similar appearance

2 Interstitual endometritis is often combined with chronic metritis. It has been called fibrosis uteri. The uterus is larger, firmer, and heavier than normal

Microscopically, curettings show a dense fibrous stroma, in which the vessels are thickened. The gland acmi are usually few in number and widely separated from one another

Tuberculosis of the uterus is a rare condition. It may occur as an endometritis with the development of ragged

caseous walls, or fibro-caseous nodules may occur in the wall of the uterus which is usually considerably thickened

Tumours -Of simple growths the fibro-myoma (leiomyoma), or tumour composed of non striped muscle and fibrous tissue, is the commonest (Fig 104) A full description is found under Turnours, p 354 Of malignant growths the carcinoma is very common.

Two main types are found -

r Squamous epithelioma occurring in the cervix

2. Columnar cell carcinoma occurring in the body or cervix.

DISEASES OF THE PLACENTA

Infarcts, s.e areas of necrosis in the placents, are not uncommon They are best developed in cases of eclampsia. They appear as opaque white or pale yellow areas, more or less wedge shaped, and towards the maternal surface They are caused by thrombosis in the intervillous blood spaces

Fibrosis.-Under the influence of the syphilitic virus the placenta becomes larger, firmer, and paler, and may present A dull, greasy appearance (see p. 395).

Microscopically, the chorionic ville are found to be thicker and show a marked decrease in the number of vessels. In the thickened stroma are numerous round and spindle shaped cells.

Tumours .- Il y dated form or resicular mole or myxoma of the chorion is a condition in which chorionic villi become greatly enlarged and ordenatous The tumour shows immense numbers of translucent globular masses like white currants, varying much in size, strong upon thin filaments It may become malignant, passing into the condition known as chorion-epitheliotna (p. 370)

Afteroscobically, the globalar masses show the structure of rivxomatous tissue, hence the term myxoma of the chonon.

There is at the same time proliferation of the covering epithelial layers—syncytium and Langhans' layer.

Charion-epitheliana is a tumour formation which, like the preceding, has a distinct relationship to pregnancy and abortion. Its appearance and nature are discussed under Tumours (p. 379). It is associated with the development of secondary growths, particularly in the lung.

DISEASES OF PREGNANCY AND THE PUERPERIUM WHICH MAY BE PATAL

It is convenient to discuss here some of the diseases of pregnancy and the puerperium which may be seen in the positionarium room. Pregnant and puerperal women may, of course, die of intercurrent diseases of various kinds. Thus, heart disease and kidney disease are not uncommonly a cause of death under such circumstances. There are, however, certain conditions more directly associated with the pregnant state which may move fatal.

In the first place there is ectopic gestation. When an ovum develops in a situation other than the uterus, such as the Fallopian tubes or ovary, death not infrequently occurs from hamorrhage into the peritoneal cavity.

Rupture of the uterus may occur during pregnancy or during labour, with resulting fatal hamorrhage.

Pulmonary embolism has already been alluded to as a cause of sudden death after labour.

Chorea gravidatum may prove fatal. In a case which came under the author's notice recently there was present—what is usually found in any fatal case of chorea—acute simple endocarditis of the mitral valve.

Puerperal fever, one of the commonest causes of death after labour, has already been dealt with under Diseases of the Uterus (acute endometritis) (p. 338).

342 DISEASES OF THE REPRODUCTIVE ORGANS

Hyperemesis Gravidarum or Pernicious Vomiting of Pregnancy—This condition of severe and sometimes fatal vomiting developing during pregnancy is believed by authorities to be toximic in origin, and probably all cd to such diseases as eclampian and acute hier attrophy. In many cases lesions of the liver, similar to those occurring in the latter disease, are found. In some cases the liver shows a fatty degeneration of an extreme degree, in others there are areas of necrosis similar to those found in eclampia, but instead of being mutated at the periphery of the lobule, as in that disease, they occur in the centre. Degenerative changes of a type similar to those in colampias are found in the kidney. The condition is associated with a high simmonia co-efficient in the unine, and there is a corresponding marked reduction in the outbut of uses.

Acute Liver Atrophy — As already stated, there is a distinct relationship between this condition and the pregnant state. For a description of the lesions found in the liver see p. 212.

Eclampsia. —This is perhaps the commonest cause of death in such cases. The disease may prove fatal either during pregnancy or after the burth of the child. It is associated clinically with more or less marked albuminuma (sometimes also blood and casts) and with the occurrence of fits.

The cause of the condition is at present uncertain

As regards the post merican findings in fatal cases of the disease, these vary considerably in different cases. There are, however, certain appearances found with considerable constancy. Post merican changes are often appearly well marked. There is often a general interest that of the kin (Edema of the subcutaneous tissues may be present bacess of fluid in the pentioneal, pleural, and pericardial sace is also a fairly constant finding. The heart muscle is jobs.

and soft The organs which show the most constant changes are the liver and kidneys

The appearances in the liver when well marked are exceedingly characteristic. The organ is usually somewhat enlarged The surface has a dark red appearance, either in whole or in part from the occurrence of more or less extensive subcapsular hemorrhage. In consistence it is usually soft. The cut surface shows a yellow appearance, with hemorrhages scattered through the substance, chiefly in the portal spaces. The necrotic areas, so characteristically present when sections are examined under the microscope, are, as a rule, too small to be seen by the naked eye. Occasionally the liver may show the appearances of cloudy swelling and early fatty change without the occurrence of hemorrhages.

Microsoptically, there are found (1) changes in the liver calls characteristic of cloudy swelling, (2) more or less marked fatty change untensified round the necrotic foci, (3) areas of focal necrotis somewhat similar to those found in typhoid fever in which the liver cells have undergone extreme degenerative changes. They are swellen and Vaccolated, or have broken down and disappeared. Fatty change is not as a rule present in the rells within such for Endothelial cells and leucocytes are present along with red blood corpuscles. These necrotic foci are found chelly at the margin of the lobules, (4) areas of hemorrhage in which the tissue is infiltrated with red blood corpuscles.

Changes in the Kidney —As prev ously stated, there is in the unit distinct evidence that the kidney is damaged, that, in other words, a degree of acute nephritis is present. But even in cases where the time shows most indications of disease comparatively little change may be found in the kidney itself, more especially microscopically. The organ is somewhat enlarged and pale. On section, the cortex is swollen and tends to stand up above the level of the medulla (Fig. 83). The colour of the cortex is a pale yellow,

occasionally with harmorrhages scattered through it. In consistence the organ is softer than usual Unless the case is complicated with chronic renal disease, the capsule strips perfectly, leaving a smooth, pale surface

Microscopically, as already indicated, the changes are less marked than one would have expected from the examination of the urine. There is (1) always more or less exidence of cloudy swelling of the renal epithelial cells, especially of the cells hinge the convoluted tubules. (2) There is more or less fatty change in these cells, but this is never very marked (3) There is a certain amount of shedding (catarth) of these cells with a massing of the shed cells in the collecting (twoles, cells with a massing of the shed cells in the tubules.

The appearances are, in short, those of marked cloudy swelling or of an acute catarrhal nephritis, and, as already stated, between these two conditions there is no very hard and fast line.

It should be remembered in connection with the microscopic appearances of the kidneys that a degree of cloudy swelling (touc change) is practically constantly found in pregnancy

As already mentioned, infarcts in the placenta are specially frequent in cases of eclampsia.

DISEASES OF THE MAMMARY CLAND

Little need be said in such a treatise about diseases of the mammary gland. Owing to their being readily removable, growths of the gland are seldom seen post mortem.

Acute inflammatory conditions (acute mastitis) with abscess formation are not uncorrimon.

Official inflammation (chrome intertitual mostitus) is difficult to distinguish clinically and by the naked eje from carennoma. It occurs as a hard mass, ill defined, in the substance of the gland On section it appears as white-looking issue radiating through the fatty its sue of the breast

Microscopically, the condition is characterised by the development of a large amount of well formed fibrous tissue with isolated islands of glund tissue scattered through it. Cysts formed by dilated gland acini are often present.

Tuberculosis is occasionally met with in the form of multiple caseous foci surrounded with fibrous tissue scattered through the gland substance

Tumours—The mammary gland is one of the organs in which tumour formation is most common. No doubt this is due to the fact that the breast is periodically undergoing hypertrophy and involution and also to the irritation to which it is subjected from trauma and acute inflammatory processes

Simple tumours, such as adenoma and cystic adenoma, are dealt with among tumours under these headings (p 359)

Caranomata are dealt with under adeno-caranomata

Although primary carcinomata of the breast are seldom met with in the post mortien room, the secondary deposits are frequently seen. They may occur in the lungs (Fig 55), or disseminated through the body, often showing a marked preference for bone.

DISEASES OF THE TESTICLE

Such diseases do not often come under the notice of the pathologist in the post mortem room.

Tuberculosis of the testicle is not infrequently associated with generalised tubercle and with tubercle of the genito-unnary tract. The condition tends to develop first in the epiddymis and may remain localised there.

Syphilis -Two chief types of syphilis are found in the testicle

- I Gummata —These are firm white or yellow caseous looking masses which have to be distinguished from surcomata
 - 2 Interstitual Inflammation or Fibrosis A slight degree

of this is not uncommonly met with even in cases which show few other manifestations of the disease. Bands of white fibrous tissue are seen running through the characteristic slightly brownish tinged soft testicular substance

Tumours—Sarroma is the commonest tumour of the testicle. It is often of the large round cell type, and in appear ance (owing to accompanying necrossis) sometimes resembles a gumma. Such tumours are rarely seen in the post mortem room, but the recurrences in the retropentoncal glands may be met. Such recurrent sarromant may status a large size.

DISTASES OF THE PROSTATE

The prostate is one of the most important glands in the body from the pathological point of view, and this for two reasons. First because it so commonly undergoes enlargement in later life, and recondly because any increase in size obstructs the urethal channel and leads to accumulation of unne in the bladder, and to various sequels: involving both bladder and kidneys.

Normally the prostate measures 36 by 30 by 18 mm, and weight about 20 grammes It is usually stated to consist of three lobes, two lateral and one median lobe It is enlargement of the middle lobe which leads to the most serious results

Hypertrophy—To what extent the simple enlargement which the gland so constantly undergoes in old age is to be regarded as a hypertrophy and to what extent is a notplann is doubtful. In many cases the enlargement being more or less uniform, it is probably merely hypertrophy. In other unitances there is a localised projection of one or other part, usually the middle lobe, when the appearances are runch more in keeping with those of a tumour formation. From the nucroscopic point of view there is no pronounced difference between the normal gland and the enlarged one. There is hyperplasa of all the gland elements, both epithelial and

intersitial, the interglandular usue consisting of fibrous strands intermixed with non-striped muscle and often showing areas of round cell infiltration. The gland acum are frequently dilated and cystic, and show the formation of intra acunous projections. The lining epithelium is cubical or columnar. The concretions known as corpora amylacea are very constantly present, although they probably do not occur in such large numbers as in the normal gland. They appear as round or oval bodies with concentric lamination not unlike starch grains.

As soon as the enlargement obstructs the urethral canal tuckening of the bladder wall takes place, and usually also diduction. With further uncrease in size of the prostate the bladder fails to empty itself completely at each unnation, and the passage of instruments may be necessary in order to secure relief. This "catheter life" exposes the patient to the rule of infection with germs, and this sooner or later occurs. Thus cystitus is superadded with the risk of an ascending infection involving the pelvis of the ladneys and the ladneys themselves (suppurstive pelonephints). Sometimes a bilateral distention of the infection of the bladder.

Acute Prostatitis may occur in association with gonorrhosa or as a result of the formation of a false passage in catheterisa tion of the unnary bladder. It may also be due to blood infection, or may be the result of spread of inflammation from rectum or bladder. Abscess formation may result, and owing to thrombosis and septice softening of thrombi in the veins pyarma often supervenes.

Tumours of the prostate are very common if one includes all the localised enlargements already mentioned under hypertrophy, classifying them as adenomata or cystic adenomata. True tumours also occur. Cartriomata are common either in the form of scirrhous or encephaloid cancers. They form a frequent complication of the simple enlargement, and they show a special tendency to form metastases in bones.

CHAPTER XIV

TUMOURS

Tutious may be primarily divided into (4) Simple and (5) Malgnant. There is actually no very hard and fast line between the two varieties, certain tumours being leas malignant than others. Mercover, a simple tumour may become malignant. On the whole, however, the distinction is sufficiently well marked to serve as a basis for classification. The mass marphologoual disference between the fury trees.

is that the simple tumour is encapsuled, i.e. is more or less sharply defined from the tassues in its immediate neighbourhood, while the malignant tumour infliences surrounding tissues and erodes structures such as blood vessels. The tendency to recur when removed, and to produce misastates or secondary growths, both characters belonging to malignant tumours, are explained by this character of infiltration.

In deciding in a given instance whether a tumour is simple or malignant, certain points should be attended to

1 Pentum — Tumours of the intestine are usually malignant, while in the case of the uterus the commonest tumour is the simple mioma

2 Size—On the whole a large tumour is more likely to be malagnant than a small one, although there are notable exceptions to this

3 Ulceration —An ulcerating tumour is much more likely to be malignant than simple ...4 Necrosis - Necrotic changes are more frequently met with in malignant growths, owing to their tendency to overgrow their blood supply and from other causes

5 Hamorrhage is much more frequently met with around and in malignant growths, owing to their capacity to erode . blood vessels, and owing to the fact that their own blood vessels are thin walled and badly supported

6 Infiltration of the surrounding parts, as already indicated, is characteristic of malignant growths, while the simple tumour is, as a rule, well defined

7 Occurrence of Metastases - If such are present the tumour is malignant. It should be borne in mind, however. that simple tumours, such as the myoma of the uterus, may be multiple

Microscopic points of distinction between the two groups are as follows LLA2

1 Resemblance to Homologous Normal Tissue - This is much more characteristic of simple growths. Malignant growths deviate more or less markedly from the normal tissues which they represent They tend to resemble more closely the embryonic equivalent of the tissue

2 Character of Cells - The cells of malignant growths tend to be larger and to vary in size and shape. Their nuclei also are larger and often multiple Mitotic figures are frequently numerous in malignant growths and may show aberrant types, such as multipolar division

3 Infiltration of surrounding tissues is again a micro scopic character of malignant growths, while simple tumours are encapsuled Associated with this character is the tendency to erode blood vessels and other normal structures

A Inflammajory changes in the tissues around are found in connection with malienant growths, while simple tumques excite little reaction

5 Necrosis is again more characteristic of the malignant type than of the simple

- 6 Hamorshage more or less extensive is characteristic of malignant growths and is due as a rule to escape of red blood cells from thin walled imperfectly developed blood vessels, but may also be due to erosign of vessels by cancer cells.
- 7 Relation of Epithelial Cells to Stroma—In glandular turnours of the sample type a basement membrane is usually present. In malignant growths this is absent
- In the following description of the common tumour formations no elaborate system of classifications is adopted Any such system of classification must of necessity be tentative, pending the discovery of the cause of tumour growth Further, exceptions to roles are so frequently met with in relation to nocoplaism that the most elaborate system breaks down at many points unless each tumour be placed in a category by itself

In addition to the pathological names in common use for tumours there are some terms employed more particularly by clinicians, which require definition

Folyour or folyo is a term applied to any mass gimsing from a mucous surface and attached to it by a narrow stalk Such polyon are to be found in the note, rectum, bladder, and uterus. They vary much in structure, some, *g the nasal polypus, consists metely of edomatous murous membrane, others are notlibraste, mornalit, or adenomatic, or administration.

A area is a name given to two types of growth which occur on the skin the angiona and the pigmented mole. The term is derived from a Latin word meaning birth mark. Hence its application to two different conditions

Mole is used for a form of birth mark found on the skin which is deeply pigemented with melania and sometimes rovered with laris. It is also employed in the term by datifiform mole to characterise a degenerative or neoplastic condition of the chorionic vills which sometimes occurs in pregnancy

1

A. SIMPLE TUMOURS

Tumours composed of Fibrous Tissne

Fibroma — This is a tumour composed of connectivetissue cells and fibres — Two types, soft and hard, are distinguished, according as the cells or the fibres pre dominate

Sites -They may arise anywhere where there is connective tissue,-cutis, fascia, periosteum, dura mater, submucous tissue, pharynx, and nose (polypi) They are also common as minute growths in the medulla of the kidney Sometimes they occur in connection with scars (cheloids) Acurofibromatosis is a form of multiple fibroma occurring in relation to the nerves of the skin or, more rarely, the internal organs. The name of Recklinghausen's disease is often given to the condition. The tumours occur along the course of the nerve trunks, and show, as a rule, the structure of soft fibromas Sarcomatous change may occur in them, especially in the deeper seated varieties. Tumours of the medullary portion of the suprarenal glands as well as pigmentation of the skin are sometimes associated with the disease Xanthoma is a small brownish vellow tumour. often multiple, which occurs chiefly in the evelid. It may he congenital, but more often develops late in life, some times in association with jaundice and diabetes. There is a difference of opinion as to the exact nature of the condition, but it would appear to be a fibrous tissue formation with storage of lipoid material in the cells

Appearance — Usually a well defined rounded or lobulated and encapsuled nodule, soft or hard, firm in consistence, pink or white, the softer type tending to be pink, from its greater vascularity. The cut surface sometimes has a watered silk

appearance. Degenerative changes, such as myxomatous, ordematous, calcareous, are sometimes met with

Microscopically, the appearances are those of ordinary connective tissue Sometimes the cells predominate, at other times the intercellular material, according as the tumour is of the hard or soft variety The cells are usually spindle shaped. but in the more cellular types may be rounded. The intercellular material consists of wave collagenous fibres, staining deep red with eosin and with acid fuchsin

Tumours composed of Myxomatons Tissue

Myxoma.-This is a somewhat rare tumour composed of mucoid or myxomatous tissue, an embryonic form of con nective tissue. The umbilical cord is largely composed of such tissue Certain connective tissue tumours-fibromata. fibro-myomata, chondromata-are not infrequently in part composed of myxomatous tissue When occurring in relation to tumours composed of more adult tissue, the change is recarded as a degenerative one

Siles -Such tumours may be found in any of the sites in which fibromats occur, most commonly in subcutaneous and submucous ussue. Not infrequently such growths show a tendency to diffuse themselves and invade surrounding structures, such are to be regarded as surcomata. The placental or hydatid mole is often classified as a myxoma (myxoma of the chorson, p. 340).

Appearance - Very soft and gelatinous, not infrequently the material when manipulated forming long strings. Translucent, sometimes with minute hamorrhages

Murascot cally, the growth is found to be made up of rounded, spindle shaped and branching cells, widely separated from one another The material between the cells is homoceneous or slightly fibrillated, and usually stains very faintly Vessels are of course present and hamorrhages may be found.

Tumours composed of Fatty Tissue

Lipoma — Sites — Subcutaneous tissue, especially parts hable to pressure, e.g. shoulders, buttocks, wall of large bowel, kidney, rarely brain.

Appearance —Such tumours vary much in size, may be very minute, occasionally very large, are usually lobulated, and resemble fatty tissue

Microscopically, they consist of adipose tissue with bands of supporting fibrous tissue carrying blood vessels. All stages in development of fat cell are found from fibrous tissue cell, with minute globule of fat, up to cell with merely thin rim of protoplasm and nucleus pressed aside by large fat globule. Crystals of fativ acids are often present in the cells.

Tumours composed of Cartilage

Chondroma.—A tumour composed of cartilage either hyaline or fibro-cartilage

Sites—It is occasionally found growing from cartilage of rib of larynx (ecchondrors) more usually in relation to bone or in the interior of glands such as parotid, testicle (enchondroma). One of the commonest sites is the periosteum of long bones, especially at the ends of the metacarpals and phalances.

Appearance—It is a rounded or lobulated tumour, firm and elastic, surrounded with a fibrous capsule which sends in trabeculæ between the lobules Not infrequently it shows calcification or soft areas of myxomatous degeneration

Microscopically, the tumour is found to consist of lobules of cartilaginous material composed of rounded or branched cartilage cells lying in spaces between which is a matrix, sometimes homogeneous, at other times fibrillated, occasionally myxometous. Calcified areas which take on the hæmatoxylin stain deeply are not infrequently met with. The tumour is surrounded with a connective tissue capsole carrying blocd vessels, prolongations of which dup down between the lobules

TUMOURS

/ Tumcurs composed of Bone

Consideration Two varieties are distinguished (t) the comman cell-distinated vory exostess found in connection with
the bones of the skull, (c) the spongy osteoma, in which the
bony trabecular are thunner and more widely separated.
The exostess found in connection with the attachment of
muscles are probably not true tumours. They are more of
the nature of hypertrophies of bony tissue, i.e. ossification
following frauma or irritation.

Tumours composed of Muscle

Myoma —Two varactes are distinguished (i) the rhabdomyoms or tumout composed of striped muscle fibres, which is very rare, usually congential and commonly malignant (sarcomatous). It is found in the kidney and testicle, and is due to inclusion of portions of the lumbar muscles (i) 2 Leismyoma, a very common tumour composed of non striped muscle fibres.

Stits—Leiomyomata are found by far most frequently growing in the wall of the uterus. They may also occur in other positions where non-striped muscle is found, such as the alimentary tract, more especially the esophagus, also bladder and prostate.

Appearance—In the uterus the tumours are frequently multiple. They vary greatly in size, from something just visible by the unsided eye to a tumour the size of a foctal head. They are most frequent in the body of the uterus but also occur in the cervas.

Three varieties are distinguished according to the position in the uterine vall, viz (1) intramural, (2) subserous, when projecting into the peritoneal cavity and covered with per toneum over the greater part of its surface, (3) submucous, when projecting into the eavity of the niterus (Fig. 104).

The tumours are rounded and well defined from the neighbouring muscle. On the cut surface they are usually pink in colour and show an appearance like watered silk or balls of cotton. Degenerative changes are common in myomata, e.g. myxomatous change, calcification and a necrotic change known as "red softening".

Microscopic Appearance - The tumour does not differ in any essential respect from the normal uterine wall tissue. It is composed of bundles of (1) non striped muscle fibres running in all directions and therefore in sections cut sometimes longi tudinally, sometimes obliquely, sometimes transversely, (2) fibrous tissue running between the bundles and between the individual fibres. So markedly does this fibrous element enter into the composition of the tumour that the term "fibromyoma" is often employed In the myomata found in the esophagus the amount of fibrous tissue is much less. The individual muscle fibres when cut longitudinally are elongated often sinuous structures with similarly elongated nuclei fibrous tissue often shows degenerative changes (1) myxomatous, (2) hyaline, (3) calcareous Blood vessels with well-developed walls are always present Sometimes gland acmi are scattered through the fibro-muscular tumour (adeno-myoma)

Tumours composed of Vascular Tissue

Angioma —Two primary varieties may be distinguished, viz (i) hemangioma, (e) lymphangioma, a further subdivision of each variety into (a) plexiform or capillary, and (b) cavernous may be made

Sites and Appearance—Hemongomets are most usually found in relation to skin or miscoss membrane. They may be merely areas of purple colour, the so-called 'port wine stains,' or they may project and may even be pendulous. They are always dark red in colour and are often pulsatile. These cutaneous angiomata most usually belong to the plexiform variety, but may be cavernous. The caxerous type is most common in the liver, but may occur in relation to the

membranes of the brain and in the skin. It appears as a dark purple area, more or less wedge shaped, immediately under the capsule of the organ (Fig 76) The condition is much more common in the ox than in man Lymphangiomala are found in relation to skin and tongue They are probably always congenital and mostly belong to the cavernous type

Microscopic Appearances -(1) Capillary Angioma -Instead of the dense fibrous tissue of the cutis, great numbers of minute spaces lined with fairly large endothelial cells are found Some of these spaces contain blood, others are empty Between the cap flaries there is more or less loose connective

(2) Cavernous Angsoma -In this type, large spaces are found lined with spindle-shaped endothelial cells and filled with blood, sometimes with thrombi The walls of the spaces are formed of well-developed fibrous tissue

Tumours composed of Lymphoid Tissue

Lymphoma -A simple lymphoma is a rare tumour, usually small and solitary Microscopically, it has the appearance of normal lymphoid tissue, having a capsule, a reticulum in which are large numbers of fymphocytes also endothelial cells The condition is very difficult to distinguish from mere hypertrophy of lymphoid tissue. The malignant type, lymphosarcoma, is more common and much more important,

Tumours composed of Neuroglia

Ghoma - Such tumours, arising as they do from the neuroblast, are epiblastie in origin Sites -They are found in the brain, retina and spinal

broa

Appearance -As a rule they are not well defined, but merge into the surrounding brain substance. They vary much in size, may be opaque or translucent, white or pink, A slow growing, simple type is recognised, but many of them have the characters of malignant growths and may be called glio sarcomata (see p 313) Hæmorrhages frequently occur into their substance

Microscopically, such tumours are formed of small round cells with branching prolongations (spider cells) the latter forming an elited meshwork between the cells In the case of the retail ghoma, the branching processes may be absent Vessels are present which are often thin walked and may rupture, leading to harmorrhages

Epithelial Tumours

Such tumours, in addition to their epithelial elements, always possess a greater or smaller amount of supporting fibrous tissue stroma

r Papilloma.—This is a tumour projecting from an epi thehum-covered surface, composed of connective tissue and epithelial cells Two types, (a) squamous papilloma and (b) mucous papilloma, may be distinguished according to the type of epithelial surface from which the tumour grows

(a) Squamous papillomata — Sites — These are found in relation to skin, mouth, larynx, pharynx, exophagus or vagna

Appearance —They consist of a series of projections com posed of a coancetive tissue core carrying blood vessels and a covering of squamous epithelium. The epithelium is frequently much thickened and the dead material tends to accumulate between the prolongations. The skin papilloma or ordinary wart is sometimes congenital. It is commonest in childhood and is often infective, being probably due to some nucro-organism. One of the infective papillomata, the venereal wart, is found in relation to the genitals. Some are due to the irritation of chemicals, such as paraffin. Molluscium confagosium is a condition appearing as small red elevations, affecting more especially the skin

of the head, face and hands. The elevations break down in the centre and discharge a checsy material. The disease is regarded as being due to some germ not yet discovered

Misoscopic Afforances —The connective tissue core con taining vessels is seen in places in connection with the cuts. In other places there are isolated rounded areas of formus using produced by the eating transversely of one of the finger like processes. Upon this connective tissue is placed the epithelium which corresponds to the stratified epithelium of the skin and like it also is differentiation into layer. The epithelium shows a sharp line of demarkation from the subjacent connective tissue. Occasionally whorl like masses of cornified epithelium are seen smudting the "recil nests" of cancers, but these are buried in the thack layer of epithelium and do not penetrate the fibrous stroms.

(b) Mucous papillomota —Sites —These may grow from any mucous membrane—alimentary canal, bile ducts, bladder, pelvis of kidney. Some of these are undoubtedly due to organisms, viz. the condition known as occidious, which is a papillomatous condition of the bile ducts, found specially in the rabbit, due to a protozoon—the coccidium oviforme. A somewhat similar condition in the stomach of the rat is due to the presence of a small menatode

Appearance — In structure the mocous papilloma consists of a slender connective tissue core carrying blood vessels, and covered by a layer of epithelium which may be columnar, cubical or transitional, according to the site One of the commonest inter for this type is the bladder, where the growth consists of numerous delicate processes forming a sea-anemone-like mass

Microscopic Applearances — A connective tissue core of great delicacy, carrying blood vessels, dividing and again dividing, is seen in connection with the submucous coat of the tumour Many of the branches are, however, cut transversely Upon this connective tissue core is placed the epithelium

which may be transitional (in the case of the bladder) show ing numerous layers of elongated epithelial cells tending to become loosened and to separate in the more superficial layers. In the case of the intestinal and ble duct papilloma the epithelial cells are columnar. Mitotic figures are often numerous in the cells of the villous papilloma of the bladder

2 Adenoma is the term applied to a simple timmour composed of gland elements. Such tumours contain, in addition to the epithelial gland cells, a larger or smaller amount of supporting fibrous tussue. In this connective tissue the nutrient vessels run. When the fibrous tissue is large in amount, the term fibro-adenoma is used. Often the gland acim in the tumour become dilated (cystic adenoma). Occasionally (breast and ovarian adenomata) within the cysts there is a papiliomatious development of the epithelial elements supported by fibrous tissue (papiliferous cystic adenoma). Such tumours are generally regarded as being of doubtful simulative.

Sites —Any gland may be the site of origin of an adenoma. The commonest site for such tumours is undoubtedly the mammary gland. The prostate, thyroid, liver and other clands may be the seats of similar tumours.

Appearance — Such tumours are round or lobulated, var much in size, and are surrounded by a fibrous capsule so that they are readily shelled out The colour is whate or pink, and on section munute clear foot representing groups of gland acust may be seen Cysts are often present Another common site for adenomata is the ovary, forming the so-called compound cystic adenoma. The cysts are often very large and contain mucmous material

Microsophically, the essential parts of the tumour are (1) gland acm lined with epithelium, resembling that of the gland from which the tumour arises set upon a basement membrane Secretion may be present, colloid material in the case of tumours of the thyroid gland, mucinous material in the

compound cystic ovarian tumour. The acini are not infrequently dilated, forming cysts of various size. Intracysic papillomations projections also covered with epithelium may be found, and in the case of the breast tumours small rounded masses of florous tissue, the so-citled intracanallucial fibromata. The epithelium in the case of the ovarian tumours is markedly columnar in type.

(2) Fibrous supporting tissue, which varies much in amount, sometimes, in the case of the fibro-adenomata, occurring in large bands which separate the groups of gland army widely from one another. Running in this connective tissue stroma are the blood vessels of the timour, as a rule, well developed.

R MALIGNANT TUMOURS

The general characters of malignant growths and the points wherein they differ from the simple tumour have already been discussed. The chief characteristic of such growths is the tendency to immeds normal structures, so that they infillized the tissues in which they arise and tend to erode blood and lymph vessels, and to pass by these in the form of tumour embols to other parts of the body.

The term cancer is sometimes used generically for such growths, but the pathologist usually reserves that term for the epithelial type of malignant growth

Microsophically, the malignant tumour is characterised by an imperfect repetition of the normal tissues. Whereas the simple growth resembles, in many cases very closely, the normal adult issue from whatch a raises, the malignant tumour shows cons denable deviation from the homologous normal issue. It tends to resemble in many instances the embryonic relation to them.

Hence the use of the term "atypical" in relation to them.

Just as simple tumours may be divided primarily into (1) those arising from and composed of connective tissue and (2) those arising from and partly composed of epithelal tissue, so in the case of the malignant growths we may distinguish

a connective tissue and an epithelial group. The former are sarcomata, the latter carcinomata or true cancers,

SARCOMATA

These are tumours which are essentially cellular, secontain a minimal amount of interellular material. The cells are of the connective tissue type and are embryonic, se imperfectly differentiated. So that what appears to be the most advanced stage of development of which the tumour cells are capable corresponds with an early stage in the development of a fibrous tissue cell from the primitive round connective tissue corpused.

Under normal curumstances, either during development or in the course of the laying down of new tissue in the process of healing, the connective tissue corpusele passes from a small round cell with small round, relatively large, nucleus and small amount of protoplasm to the large round cell with abundant protoplasm. The cell then becomes oval and eventually spindle shaped. Subsequently from the protoplasm there are split off collagenous fibrils which form the intercellular material.

In this type of growth the cell which has taken on tumour characters may stop at any one of these stages and subsequently reproduce cells of a similar stage of development and no other type. Seldom does it occur that the fully-developed type of connective issue cell is found in the sarcomata. It is usually the more primitive types which are found. Occasionally a timour which shows a high degree of differentiation of a less high degree. Thus a tumour with the characters of a fibroma may on recurring exhibit a differentiation of a less high degree. Thus a tumour with the characters of a fibroma may on recurring (recurrent fibroid) assume the characters of a strooma.

As the name sarcoma indicates, such tumours are fleshlike his a rule liney form large masses of opaque white or faintly pink material. Necrotic areas are not infrequently present, and harmorthages are very common. Certain types are very vascular (angiosarcomata) and some develop pigment (melanotic sarcomata).

In consistence sarcomata are commonly soft, sometimes diffluent, and often show areas of more marked softening. They are, however, sometimes firm and may even be hard Like other forms of mahignant growth, they show a marked tendency to indiffrate and thus are seldom encansuled.

Although, as already stated, they tend to stop short of the fully-developed form of the connective tissue from which they arise, such cumours not infrequently reach. Far degree of differentiation of tissue. Thus those arising from cartilage tend to produce cartilage, those arising from bone produce bone-like tissue, those arising from muscle may produce muscle cells, and so on That differentiation forms a basis for classification. Hence we speak of chondro-sarromata, osize-sarromata, etc. A majority of these tumours, however, meetly exhibit the various stages of development of the connective tissue cell. In order to classify them we use such terms as small round cell sarroma, large supin del sarroma, small spindle cell sarroma, large spindle cell, fibro-sarroma, mail spindle cell sarroma.

As a rule, the less differentiated the type of cell composing the tumour the more malgnant it is. Thus the small round cell surcoms is one of the most malignant types. Sometimes a tumour starts by being simple but becomes malignant, either a portion of the growth assuming the malignant type, or the whole tumour, as in the so-called recurrent fibroid, becoming more and more malignant at each recurrence. This prepares one for the fact that there are degrees of malignancy.

Sarcomata very commonly produce metastases Such metastatic growths are found not so frequently in lymph glands as in the internal organs. Hence the statement that these tumours spread more by the blood than by the lymph channels This is true up to a certain point, but there are exceptions, particularly in the case of the melanotic tumour which often spreads by the lymphatics

As regards sites of origin, such growths may arise in any part of the body in which connective tissue is found, and this means anywhere at all. There are, however, certain parts and tissues more commonly affected than others. Thus, subcutaneous tissue, intermiscular septa, fasciae, perosteum, hone, lymph glands are common sites of origin. As regards the secondary deposits, these occur more commonly in the lung than in any other origin (see p. 186).

Types of Sarcomata

Small Bound Cell Sarcoma—This is a white, grey or punk, solt, sometimes diffluent tumour, found primarily in connection with subcuttaneous tissue, bone, mussles, brain testicle, and secondarily anywhere, but most commonly in the lungs. Harmorthages and areas of necrosis are frequent. The tumour is one of the most malignant types known.

Mitorosopisally, such tumours are composed of small mand cells closely packed, with scanty protoplasm and small dark stanning nuclei. The cells resemble very closely the lymphocyte of the blood and lymph glands. The intercellular material is scartly, granular or slightly fibrillated. The vessels are thin walled, often consisting of a single layer of cells Hemorrhages and areas of necrosis are frequent.

The so-called Ixmphosarcoma may be regarded as a subvariety of the above It originates in lymphoid tissue, very commonly the lymphatic glands of the mediastinium, and is very malignant. In appearance it resembles other types of sacroma (Fig 56)

Microscopically, such tumo its are composed in large part of small round lymphocyte like cells with rather more intercellular material than in the case of the ordinary type of small round cell sarcoma There is often a fair number of larger flattened or polygonal cells, representing the endothelial elements of lymphoid tissue. Occasionally this larger type of cell is the predominant one (endothelioma)

Large Round Cell Sarcoma.—These tumours have much the same appearance as the above, but tend to be on the whole firmer in consistence. The sites of origin are also much the same, but the testicle, pharynx and posterior nares and muscle are perhans more commonly affected.

Microscopically, as in the previous type, the tumour Is composed easternially of cells, but there is more intercellular material, and the fibrils of which it is composed are thicker. The cells are of course larger, rounded or polygonal with more abundant protoplasm and a nucleus with a side-meshed network, hence estatung less deeply. Areas of necrosts and harmorrhages are common. The vessels are better developed. Sometimes the cells have an alweolar arrangement

Small Spindle Cell Sarcoma, -- Such tumours resemble the preceding but are more benign

Associately, the tumour is composed of small out shaped collar ranged irregularly in bundles. The cells represent a further stage in the development of the connective tissue corpusale. The vessels are, however, still very imperfectly formed.

Large Spindle Cell Barcoma.—In this type the fast creatation may be visible to the naked eye. The tumour bears considerable resemblance to a fibroma. It is, moreover, firmer than most other types. Such tumours occur in relation to pernostrum, musekes, mamma, or ovary.

Microscopically, the cells are arranged in bundles. There is a considerable amount of interechilar Abrillated material, and the vessels are fairly well supported. It is difficult in many instances to differentiate such growths from cellular fibromata. The cells tend, however, to be larger and to vary more in size, and minotic figures are often present.

From the microscopic point of view it is a matter of great difficulty in many instances, especially when only a minute portion of tissue is available, to differentiate such tumours from granulation tissue. Nothing less than long experience will enable the pathologist to do thus in many cases. The point to attend to is the uniformity of type in the cells in the ease of granulation tissue all stages of development of the fibrous tissue cell will be met with, whereas in the case of the sarcoma the cells tend to be all of one type, round or spindle, as the case may be case may be to ease may be the case may be

Mixed Cell Earcomata are met with occasionally. In such, in addition to round and spindle cells, giant cells (multinucleated masses of protoplasm) are often found

To this type belongs the myeloid or giant cell sarcoms found in relation to bone

Sites—Such tumours occur in young subjects, chiefly in the upper end of the tibia and fibula, the lower end of the femur and in the lower jaw (malignant epulis, Fig. 109)

Appearance—These tumours are slow growing and show generally a low degree of malignancy. They do not tend to produce metastasis and rarely recur when removed. They grow from the interior of the bone, distending and timining the overlying bony tissue. They show the appearances of ascromatia generally, but hismorrhages are specially frequent.

Microscopically, myeloid sarcomata are usually composed of syndide shaped cells with large multinucleated masses of protoplasm scattered more or less regularly through them. These gant cells are sometimes absent over considerable areas. They may be differentiated from the gunt cells of toberculosis by their nuclei occurring all through the cell, especially in the centre, whereas the tubercle guant cell has its nuclei arranged in a zone at the margin.

Glio-sarcoma is a type found in the central pervous system and retina. It is the malignant analogue of the glioma and resembles it in appearance (see p. 313) Sarcomata sometimes show a greater amount of differentia tion of tissue. Those ansing in connection with hone may show a tendency to form cartilage (chondre sarcoma) or long (casteo-sarcoma) or a muxture of the two. Such tissue only imperfectly reproduces the structure of its normal homologue. The cartilage is very irregular and has a marked tendency to undergo myxomatous change. The bony tissue is only imperfectly formed, the calcarcous maternal being deposited in rather than combined with the intercellular tissue. Necrous and harmorrhage are prominent features of such timuous

Endotheliona — Sites — Thus is a term of somewhat indefinite significance applied to timous occurring in connection with serious membranes such as the pleura, personneum and dura master, but also in other patrix of the body in relation to lymph and blood channels and lymph glands Apparently they may originate in any position where connective tissue tends to assume a flattened character in consequence of forming a lining to a channel, space or cavity.

Appearance - Such tumours have the characters and appearances of sarcomata in general

Microscopically, the chief characteristics a tendency for the cells to group themselves so as to form rounded or irregularly shaped spaces into which the flattened or polygonal cells project. Owing to the above-mentioned in croscopic appearances the term alreads sarrown so often applied to these tumours.

Penthelioma is a term applied to a neoplasm in which there is whorl like arrangement of the constituent cells round a central blood or lymph space, the cells being of a flattened or polygonal shape. Such tumours are found, specially in the central nervous system, growing from the membranes of the brain or cord. Sometimes in the centres of these whorls of cells instead of a space there may be a mass of calcurous matternal. Such tumours have been

called Psammomata or "brain sand tumours" They occur in relation to the cerebral meninges and ventricles

Angiosarcoma.—Closely related to the above are malignant growths in which spaces containing blood are the principal feature. The spaces are lined with endothelial like cells. Such tumours have of course a very vascular appearance. They are not uncommon in the brain, and are found occasionally in the spleen.

Myelomata are tumours which arise from one or other of the blood forming elements in the bone marrow. The cells composing them are rounded or polygonal and may resemble the myelocyte, jumphocyte, nucleated red cell or plasma cell. They occur as multiple white masses in the interior of bones such as stemium, ribs, spinal column, skull, femur, humerus. They destroy and distend the bone, leading sometimes to spontaneous fracture. In the urine a peculiar form of albumose (Bence-Jones albumose) is some times found in such cases.

MELANOTIC TUMOURS

Melann pigment occurs normally in the deeper cells of the stratum Malpinghi. Subjacent to these, in the cuts vera, are certain spindle-shaped cells which may contain pigment and which are known as chromatophore cells. Whether these cells elaborate the pigment from the blood or bear it to other destinations from the epithelial cells is uncertain. Similar pigment is also found in the choroid and in the ins. The chemical characters of the pigment vary somewhat according to the site, but as a rule it contains a considerable quantity of sulphur and little or no iron. In colour, under the micro scope, the pigment varies from yellow to dark brown. To the naked eye it usually appears almost black.

Pigmented Moles—These are congenital melanous tumours of a simple type which are also sometimes known as "navi" They are exceedingly common occur on almost any part of the skin surface, and seldom give rise to trouble, although they occasionally become malignant They con sist of the enlarged papille of the skin, which may project considerably, are usually more or less deeply pigmented with melanin, and may have bears growing from them.

Microscopically, the enlargement of the papille is found to be due to collection of epithelead cells with relatively large pale staming nuclei. These are often known as 'nævus cells' and their origin is a much debated point. Some regard them as rounded chromatophore cells, others as cells of epithelial nature. They contain melanin pigment in varying amount, and masses of similar pigment are also found outside the cell groups. The use of the term nævus is perhaps unfortunate in toward the employment of that term for angiomas of the skm. But there is no very clear hine between the two types of growth, the pigmented moles sometimens showing blood channels.

MELANOTIC SARCOMATA AND CARCINOVATA

The exact position from the point of view of classification of many of these melanotic tumours is uncertain. Some have the microscopic characters of sarconata of the spandle cell type. In others the cells are polygonal, and others again have the appearance of epithelonata. Pignented meso blastic cells are found in the choroid and ris, and, as we have seen, cells resembling connective-tissue corpusales (chromato-phore cells) are found in the cutis, but whether these latter form the origin of melanotic tumours is uncertain. The pignent-containing cells in the pignented miles are also of uncertain nature. Many of these melanotic tumours probably arise from the cells in the deeper layers of the stratum Malpighu, and are therefore of epithelial origin and should be classified with the exercisionmata.

Sites—Tumours which contain melanin are met with primarily in connection with the skin (particularly in relation to pigmented moles) and with the eye. Secondary deposits occur specially in lymphatic glands and in the liver. Such tumours, as a rule, are exceedingly malignant in the sense that secondary growths may occur early when the primary tumour is minute.

Appearance—The appearance of such tumours is very characteristic owing to the presence of the melanin, which imparts a dark brown to black colour to the growth. The pigment may, however, be present only in parts, the pigment-free areas having the appearance of an ordinary sarcoma. The student should be careful not to fall into the error of calling a neoplasm in the lung, where carbon pigment is normally present, melanoute.

Microscopically, such tumours, as already stated, vary considerably. The cells may be spindle shaped, polygonal or epithelioid. The pigment is present within the cells and in masses outside. Considerable areas of the tumour may have no pigment present at all. The pigment is yellow to dark brown in colour and is exceedingly resistant to reagents of all kinds. For its demonstration sections of the tumour should he stained in the nuclear dye (e.g. hematein) only. The cells often have an alreolar arrangement.

Figment of a yellow, brown, or black appearance occurs in tumours other than melanotic growths. Attention has already been drawn to the fact that tumours of the lung and mediastimum inevitably show pigmented areas of a black colour due to carbon. Tumours with old hierorrhagic foci in them are likewise pigmented. The pigment is yellow or hrown in colour due to deposit of hierastoidin. There is intile likelihood of the student inistaking these for melanotic growths except under the microscope, as the pigment is small, in amount, and, localized, on the neighborhood of the thirt of the thirt is the pigment resulting from hierarchage is lighter in colour, yellow

rither than think brown, and it is sometimes in the form of annular crystals, whereas melanin pigment is always amorphous

CARCINOMATA OR CANCERS

These are malignant tumours, the extential constituent of which is epithelium. In addition to the epithelium there is always a greater or smaller amount of connectine fissue strong, which supports the epithelial elements and in which run the nutrent vessels. This strong is derived in part from the pre-existing tissue of the area in which the tumour occurs, to a much greater extent it is a new development from the fibrous tissue of the host. It is this occurrence of two distinct types of tissue—epithelial elements and supporting connective tissue scaffolding—which distinguishes this type of malignant growth from the sarcomata. In the case of the latter the cells tend to be all of one type and are diffusely arranged

Inasmuch as there are two main types of epithelium— (t) the stratufied squamous type, covering stan and lining mouth and easiophagus, (t) the glandular type, covering the intestine and forming the secreting elements of glands—so there are two main types of carenionata (t) Squamous enthelomati. (a) Adeoc-caronomata

The characters of these tumours are those of malignant growths in general. The man underlying property is that of invasion of the normal trainer. Sometimes, in the case of a tumour of a surface such as the skin or of a luming membrane of a viscus such as the bowde, enlargement may take place mainly by projection of the growth. Such an appearance often receives the name. fungating 'timour (Fig 69) As a rule, however, the tumour grows chiefly by penetrating the healthy tissues around

When growing on one of the surfaces—skin or bowel ulcration of the growth very soon occurs This leads to invasion of organisms and absorption of toxins an important factor in the production of the cachexia of cancer

The erosion of the tissues by the cancer cell elements leads to imaxion of lymph and blood-exists. It is chiefly by the former that carcinomata spread, so that the secondary deposits are to be sought for first of all in the nearest lymphatic glands. Spread may also occur by way of the blood-stream, secondary foci occurring in the internal organs such as liver and limes.

This invasion by the cancer cells is resented by the normal tissues, with the result that an inflammatory reaction of a subacute type occurs in the tissues at the growing margins of such growths. This inflammatory reaction manifests itself by an infiltration of the tissues with small round cells similar in appearance to the lymphocytes of the blood but in reality of diverse onem

The metastaset resemble as a rule the primary growth fastly closely. They show the same division into epithelial elements and supporting fibrous tissue. The tendency is, however, for the epithelial elements to show less marked differentiation. Thus in squamous epithelomata the secondary deposits may show hittle or no tendency to cornification and formation of cell nests.

The canter tells themselves vary greatly in shape and appearance. As a rule they tend to be larger than their normal homologues. They may show evidence of secretory activity when they arise from glandular epithelium. This is indicated by vacuolation of the cells and by the accumulation of imicinous or colloid material in the gland spaces. They do not preserve the normal relationship with their surroundings. Thus the groups of gland cells have no basement membrane Instead of the normal single layer of cells forming an acmus there are often several layers.

Milotic figures are often numerous, ther number being taken as a measure of the rapidity of the from the figure.

The figures are frequently abnormal, showing multipolar division The chromosomes are more often heterotypical (i.e. rounded instead of V-shaped—a condition characteristic of the stage of maturation of the sexual cells) than is the case in the cell dividing normally

Vanous forms of inclusions are commonly met with in the cance cells. These are howen as a "cancer bodies," and have from time to time been taken as representing parasites of vanous types. They are produced by the phagocytic activity of the cells taking up leucocytes, other cancer cells, red blood corpusales, set. They appear as rounded bodies, usually with a distinct space surrounding them. Other bodies occurring mainly between the cells, usually in groups, are found. They are known as Russell's fuchain bodies, and probably represent hyaline degenerations of cells or segregations of cells or segregations of cells or segregations.

Carcinomata occur (1) at or near the onfices of the body—
ip, tongue, rectum, vagina, (2) at points where normally
there is narrowing of a canal—pyloris, job occue lavley.
(3) at points where a canal changes its direction—hepatic,
splenic, simoid flexures of large intestine, (4) in glands such
as the mammary, and in organs such as the uterus, which
are periodically undergoing hypertrophy and involution. In
other words, there is a marked association of cancer with
chronic irritation of various kinds

The tumours commonly grow from a single centre. The various prolongations of the growth will be found all to radiate from a single point

As previously indicated, carcinomata may be divided into two main groups—(1) Squamous epitheliomata, (2) Adeno carcinomata or plandular cancers

I. Squamous Epitheliomata

Sites —These grow from (a) the skin, (b) mucous membranes covered with stratisted squamous epithelium, such as mouth.

esophagus, vagina, cerux uten, (c) embryonic epithelial canals, such as the thyro glossal duct Occasionally they occur where no squamous epithelium is found normally, e.g. in stomach and gall bladder

Appearances—Such tumours occasionally project beyond the general surface, forming a fungating mass More commonly they appear as ulcerated areas the margins of the ulcer being raised and hard (Fig 57). On cutting down through the floor of the ulcer so that the relationship with the subjacent tissues is displayed, the opaque white epithelium will be found penetrating the tissue for a variable distance.

Microscopically, such tumours are found to be formed of topgue like prolongations of ep thelium. Sometimes these can be traced in continuity with the original mass, at other times they are cut transversely and appear as isolated rounded masses At the spreading margin and in the early stage of the condition these columns of epithel al cells, being only a few cells thick, show no differentiation into layers. In the larger masses the central cells become flattened and undergo a change similar to the keratinisation of the stratum corneum When the columns are cut transversely the appearance is that of a central whorl of flattened cells concentrically arranged, representing the stratum corneum and surrounded by the poly gonal epithel al cells representing the cells of the stratum Malpighii, and like them showing intercellular bridges appearance is known as a "cell nest," These cell nests must be distinguished from hair foliicles and other normal structures.

The cells forming these epithelial down growths re-emble the normal cells found in the deeper layers of the stratum Malpighi. They tend, however, to be somewhat larger than their normal homologue. Mitotic figures are usually to be found amongst their nuclei, sometimes in large numbers.

Between these columns of epithelial cells are the tissues —muscle, connective tissue, glandalar structures—which have been invaded by the growth These are infiltrated by small round cells. These cells are specially well seen at the growing margin of the tumour, the appearance being known as small cound cell small between the special cells may be considered in the structure.

lymphocytes from the blood or young connective issue cells. Hemorrhages are not uncommonly met with in the marginal portions of the growth. In addition to the pre-easing issues of the part there are strands of newly formed connective issue between the misses of epithelium. These constitute the scaffolding of the new growth, and are composed of granula too issue, with a large proportion of small round cells.

Rodent Ulcer -- This is a variety of squamous epithelioma with a low degree of malignancy

Site—The condition occurs in old people on any part of the skin, but most frequently on the upper part of the face, about the root of the nose, the external angle of orbit, the side of the check and the forchead

Appearance—It appears as an ulcerated area with rauted manyin, which erodes down to the bone and may destroy the nose or ear, but which does not produce menastases and is very amenable to treatment. The tumour is believed to originate from the hair follocles or sweat glands, rather than from the epithelium proper

Microsophially, the condition is characterised by the presence of masses of epithelia cells pentitating the subjected tissues. There are certain points of distinction between this and the ordinary squamous epithelman. (2) There els are cylindrical or sy nolls shaped, and are as a rule smaller than those found in the epithelman. (2) There are no cell nests or only imperfect attempts at kernatusation in the centres of the epithelial masses. (3) There is little or no evidence of cell reaction (round-cell influstation) in the issues which are being invaded. (4) The line between epithelial masses and fibrous stroma is sharply marked.

II. Adeno-Carcinomata, Malignant Adenomata, or Glandular Cancers

These tumours are composed of gland cells arranged in alveoli or in solid masses and of intervening supporting fibrous tissue. This stroma is often absent at the spreading margin

of the growth, the gland cells occurring in and hetween the tissue elements of the part

As stated above, the epithelial elements show two fairly well marked types of arrangement. They may occur in acini, ie with an arrangement of the cells similar to what is found in most normal glands, the epithelial elements lining a space, or, on the other hand, they may occur in solid masses. In the first type the cells tend to be columnar, in the second type from nutural pressure they assume a rounded or sphemoidal form. This difference in the shape of the cancer cells is usually taken as a basis for further division mito two types, viz. (i) Columnar cell carcinoma, and (a) Spheroidal cell carcinoma. By some authorities the term adeno carcinoma is used exclusively for the first type. There are other types of carcinomata occurring in certain

glandular organs, the cells of which are arranged not in acini hut in columns This arrangement obtains in the liver, and in glandular cancer of that organ the columnar structure may be reproduced

Occasionally a tumour may show an acinous arrangement in one part and in another the cells may he massed together. At the same time the tumours of the two types preserve their characters with a fair degree of constancy. It should he noted that the terms adeno-carcinoma and malignant adenoma are often reserved for acinous cancers, and are therefore synonymous with columnar cell carcinomas.

1 Columnar Cell Carcinoma —Sites —These tumours are found most frequently in the stomach and the intestinal tract They are also found in the liver, pancreas, uterus, mammary gland, etc

Appearance—They may occur as projecting fungating masses (Fig 69), or merely as ulcerated surfaces with infiltration and thickening of the walls of the gut. There is commonly annular contraction of the gut at the affected point. Secondary deposits are common in the nearest

lymph glands and in the liver Such secondary growths have a very variable appearance

Microsopically, these tumours are mainly characterized by a downward growth of the gland elements into the wall of the viscus, so that gland acins are present in the submicious and miscular lajers. At the same time the cancerous epithelium differs from the normal. The cells tend to be larger, they vary somewhat in size and shape. They possess no basement membrane. Mitotic figures may be found in considerable numbers. There is a tendency to form several layers of epithelium instead of one, and sometimes there is no limen present owing to the multiplication of the glad cells. There is an inflammatory influvation of the normal tissues at the spreading margin of the growth. Where the tumour is projecting into the lumen of the gut, also when it occurs as large solid masses in organs such as the liver, also mit secondary deposits in glands, a stroma of connective tissue forms which carries the nutrent blood vessely.

- 2 Spheroidal Cell Carcinonasta —These tumours are commones in certain situations, e.g. breast, but they may occur anywhere. It has been customary for long to distin guish them according to their physical characters into Sarrhous or hard cancers, and Encephaloid or 19st cancers. Such names are still in use, and although the distinction depends merely upon the relative preponderance of fibrous tissue and cancer cells, it is convenient to describe them under these headings.
- (a) Scirrhous Cancer —Sites —This is found most typically in the breast, although it also occurs in stomach, intestine, pleura, ovary
- Appearance—Such tumours are opaque whate, tendinouslooking masses radiating into the surrounding parts (Fig. 103). They are very hard, and creak on being out. Opaque yellow areas of necrotic change are sometimes viable, although these are not nearly so numerous as in the encephaloid type. In the case of the breast there is very commonly indrawing

of the nipple The cut surface often becomes depressed and cup shaped

Microscopically, the tumour shows a large preponderance of the fibrous stroma element. This connective tissue in the more central parts is well developed and shows few cells. At the growing margin it is more cellular. In this fibrous stroma are elliptical spaces filled with cancer cells. The cancer cells themselves are spheroidal from mutual pressure, and there is often a space (artificially produced by shrinkage) between them and the fibrous stroma. Mitotic figures may be found. No basement membrane is present. In the centre of the growth the groups of cancer cells may be few and far between At the growing margin they are more numerous. Occasionally there may be attempts at the formation of a lumen.

(b) Encephaloid, Medullary or Soft Cancer -Sites -They occur in sites such as the breast, stomach and pancreas

Appearance—The tumours in this type tend to be larger, softer, more vascular, and there are more often areas of necrosis

Assertable and the are characterised by a smaller proportion of fibrous stroma and a larger proportion of glandular epithelium. The cancer cells vary in size, but they occur in much larger masses than in the sciribous type. Further, necrotic changes are very commonly present amongst them.

3 Colloid Caneer is a special type of Adeno-carcinoma, characterised by the accumulation of mucinous material in the spaces, which becomes inspissated and hence gum like in consistence

Sites —The stomach, large intestine and mammary gland are the common sites for such growths

Appearance —It appears as gelatinous translucent material, in greater or less amount, in the tumour and its secondary deposits. Otherwise the growth has the appearance of a columnar cell carcinoma.

Microscopically, these tumous often show up parts the characters of the ordnays columnar cell carcinoma. In other parts, the gland acons are ditated and the lumen filled with homogeneous or slighbly fibrillated material. The cells are often vacuolated from the presence of secretion. They become detached from the fibrous stroma and eventually disappear allogether, fusing with the mucinous contents of the spaces

C TERATOMATA

There remains for consideration a number of tumour formations traceable to some defect in the development of the individual, also others due to the grafting of the embryo's tissues upon the maternal organism

To the first group belongs the Teratoma properly so called or Dermoid Cyst

Such tumours are, as their name indicates, usually found in the form of cysts. The cyst wall is developed from the tissues of the host. The wall is hind by skin expitehium and encloses chiefly soapy looking material and hairs, frequently also teeth, skin, bone, cartilage, muscle, nerve elements it may be, and rudinentary viscera. The causation of the condition is, in most cases, the inclusion of the elements of one individual within the body of another. The growth is simple in nature.

Site—The site of such tumours is commonly in or near the ovary (Fig. 102), but they may also occur in the testicle, the neighbourhood of the sacrum, the side of the neck and face, also very occasionally in the brain

Appearance—The tumour varies much in size. Occasionally it may be as large as a fortal head. As a rule there is a point, the so-called "portuberance," which represents the head and from which erises a tuft of long hairs.

Microscopically, demo d cysts show a great variety of types of tissue—stratified squamous epithelium sweat glands, hair

follicles, cartilage, bone, gland acms Imed by epithelium of various kinds, etc.

To the second group (those due to the grafting of embryo tissues upon the maternal organism) belong (a) the placental mole, or myxoma of the chorion, already described on p 340, and (b) the chorion-epithelioma

Chorion Epithelioma

This is an exceedingly malignant condition which may follow an abortion or full time pregnancy, also its simple analogue the placental mole

The outer surface of the choronou vili consists of the layers of fortal epiderm. The most external (syncytuum) is formed of multinucleated masses of protoplasm (grant cells). These possess normally intense phagocytic properties, whereby the vilia are enabled to penetrate the maternal itsuse and come to lie within the blood sinuses of the uterus. Underneath this layer is a second, in which the cells are separate and do not stain so deeply. This is what is known as the Langhans layer.

After an abortion or full time pregnancy the layers of cells covering the choronic villi may take on abnormal growth, developing into a tumour which is essentially cellular (having no intercellular material), which shows no arrangement of its elements and obsesses no blood vessels.

Sites—The usual site for such tumours is the uterus, following abortion or full-time pregnancy Occasionally they occur independently of pregnancy, as for example in the testide. Such are probably due to germ cells taking on active development and producing a trophoblast (the two layers of cells covering the vills are known as trophoblast) from which the tumour anses

Appearance—Such a tumour appears as a soft spongy vascular mass in the wall of the uterus Necrosis and hæmorrbage are characteristic features of it. Metastatic growths

develop very early and are found especially in the lungs, but also in the liver and kidneys

Misrosophodly, two types of cells are found in the parts of the tumour which are not necrosed. (1) large plasmodula masses, mostly multimotested, derived from the synctium, the nuclei of which are in rapid division and show all varieties of abnormal mitoses. (2) groups of smaller, polyhedral cells derived from the Langhans layer. Both types of cell are found in the uterine wall penetrating the tissues and croding blind vissels.

TABLE OF TUMOURS

A. SIMPLE TOMOURS-

Fibroma, Myxoma, Lipoma, Chondroma, Osteoma, Myoma, Angioma, Lymphoma, Ghoma, Fapilloma, Adenoma,

B MALIGNANT TUMOURS-

(a) Sarremats—
Small round ceiled, Lymphosarcoma, Large round-ceiled, Small spindle-ceiled, Large spindle-ceiled, Mixed ceiled, Myeloid, Chondro-sarcoma, Osteo sarcoma, Endothelioma, Alveolar,

Penthelioms, Angiosarcoma, Myeloma, Melanotic
(b) Carrinomala—

I Squamous Epitheliomata.

Rodent ulcer

11 Adeno-Carcinomata 1 Columnar Cell Carcinoma.

2. Spheroidal Cell Carcinomata.

Scirrhous, Encephaloid
3 Colloid Cancer

C TERATOMATA-

IL Embryomata

Embryomata Myxoma of Chorson (sample). Chorson Epsthelioma (malignant).

CHAPTER XV

POINTS TO BE REMEMBERED IN PERFORMING AUTOPSIES ON CASES WITH A MEDICO-LEGAL ASPECT

GENERAL METHOD OF PROCEDURE IN MEDICO-LEGAL CASES

It must be remembered that all cases of death which have occurred suddenly or unexpectedly, and cases of death where no medical man has been in attendance, as well as all cases of death from violence whether the result of accident, suicide or homicade, are the subject of inquiry by the authorities—in Scolland the Procurator-fiscal and in England the Coroner—and that in all cases of the above nature a post mortem should not be made without switzing from the authorities.

It must also be noted that in cases of accadental injury to work-people, in which death ensues either at the time, or, it may be, months afterwards, a public inquiry may be held by the authorities and that therefore a post morten should not be made until the authorities have been communicated with

In performing a medico legal post mortem, the following precautions should be exercised

- I The body should, if possible, be identified by relations or the police in the presence of the doctor before the post mortem is commenced.
 - 2 Under all circumstances, such a post mortem must be complete, *: e every cavity and organ must be examined

Note -Unless there are special circumstances indicating its necessity, it is not usual to examine the spinal cord

- 3 If there is any suspicion of poisoning the following tissues should be preserved -
 - (1) Stomach and its contents
 - (2) Intestines and their contents
 - (a) Liver (at least half)
 - (4) Kidney and spleen
 - (s) Some blood
 - (6) Urine

In special cases it may be advisable to remove other organs, such as the brain, lungs, etc

A All tizsues, etc , removed must be placed in glass vessels which are chemically clean, which thould then be made air tight, sealed and labelled The label should bear on it the nature of its contents, and the date of the post mortem, and should be signed by the doctor

Each tissue or organ should be preserved in a separate vessel, and no preservative of any sort should be used

- In England the inquest held in the coroner's court is the first step in the legal proceedings under the following circumstances --
 - (1) All accidental deaths
 - (2) Homicide
 - (3) Suicide
 - (4) Poisoning
 - (5) Death from anæsthetie
 - (6) Sudden death under suspicious circumstances (2) On all persons who die in prison
- (8) In all cases in which the practitioner is unable to certify the cause of death

An inquest is supposed to be held upon all accident cases that die within a year and a day of the original injury A full post mortem is required in every case. In general,

the coroner has very httle power to decide whether an inquest is necessary or not. This decision is already made by law, and while it may lead to numerous inquests and post mortems, it is looked upon as a further safeguard to the nublic

In larger cities the coroner is always a full time officer, and is usually a physician or a lawyer. In the smaller places it is general to appoint a practitioner, who is paid according to the amount of work done and who does not receive a definite set salary.

All evidence, medical or otherwise, is taken under each and copied down, word for word, at the time of the inquest. This deposition is read over to the witness, and if correct, is signed, and is used again in any further proceedings that may be taken in the higher courts. A medical witness may use clinical and post mortem notes while making his deposition, but they must be his own and made within a reasonable time of the medical examination of the patient. Counsel may be briefed by any of the interested parties medical or otherwise, and certain questions may be put to the witness by leave of the coroner and cross-examination conducted.

Legally speaking, the coroner's court is not strictly a trial, because the prisoner or accused, if there be one, cannot be called upon to plead

In Scotland the medical examiner must write a report of the examination in "soul and conscience' form

This medical report must contain the following -

- (1) Date and place
- (2) State by whom body has been identified
- (3) Where the examination was performed
- (4) An account of the external appearances
- (5) An account of the internal appearances
- (6) Conclusion from above as to the cause of death

It is essential that any alterations should be initialled, but it is better to rewrite the report if additions or alterations have to be made

No opinions other than the conclusion as to the cause of death should be given in the report

No technical terms should be employed in writing the report. The language used should be as far as possible, popular

The report should be signed by the medical man or men, their medical qualifications being appended

The report is sent to the Procurator Piscal of the district

POST MORTEM EXAMINATION OF THE POETIS

The method of examination of the fortus differs in several respects from that which has been described in the case of the adult, and the post morten findings are as a rule very dis similar from those in the adult. In the fettus we are in most cases dealing with organs that are free from disease, death being due to injuries received during birth or to disease affecting the mother and only indirectly causing death of the fettus by interference with the placental circulation

The routine to be followed varies considerably according to whether we have to deal with a macerated fortus, that is, one that has died before the onset of labour and has been retained in utero for some time, or with one which has died diring labour from such causes as suplyication or cerebral temorrhage. It cannot be too strongly emphasised that vital information may be obtained in both cases from examination of the placents.

Examination of a Macerated Feetus

It has been found that syphilis accounts for antenatal death in about one-third of all cases. It is probably the most frequent single cause of death of the feetus before labour. Hence the very fact that a feetus is born in a state of maceration should at once arouse suspicion of the presence of this disease. In order to decide regarding its presence or absence, attention should be directed to the following points:—

- 1 The Liter—In a syphibite factus the liver is usually pale yellow in colour, firm in consistence, and may be studded over with minute greyish spots. A normal liver may weigh in the factus anything up to Atherona the factual body weight. If it weighs more than this it is probably syphilitic, although if it weighs less it does not by any means evelude syphilis. Thus asyphilitic feetal liver may weigh only That or even less of the body weight.
- z The Spiten—A healthy spleen may weigh as much as 110th of the body weight. If it weighs more than this it is probably spihitire, although, as in the case of the liver, a small spleen does not exclude syphilis. A syphilitie spleen is, however, more likely to be enlarged than a syphilitie liver. Its edders are rounded and its consistence firm.
- 3 The Placenta —A normal placenta may weigh as much as 4th of the body weight, that is, may have a weight ratio of 4 (weight ratio of an organ is the quotient obtained by dividing the body weight by the weight of the organ). This, however, only applies to a placental of at least eight months' development. Below the eighth month the weight ratio rapidly increases, and at the third of fourth month of feetal life the weight of the normal placenta may equal that of the entire focus, or even exceed it. Provided, however, that the feetus is at the eighth month or later if it has a weight ratio of over 4 (if the placenta contains no clots which add to its weight), it is probably syphilitic. The syphilitic placenta, too, in the case of the micrated feetus, has characteristic

appearances It is pole frow non vasculanty, looks large and beavy, and is thackened from the maternal to the focal surface. Microscopically, the appearances are even more characteristic. The villa are enlarged from probleration of connective tissue, they are non vascular, and, because of the enlargement of the villa, the intervillous space is dumnished in extent. It is, of course, this enlargement of the individual villa that leads to the enlargement of the entire obsecutes.

Presence of Sparocketes — The organs should be examend for sparocketes by the dark ground method, or sipermanent sections are required, by the Levaditi silver stain. The organisms are found most plentifully in the liver, lung, spleen, kidney, and suprasenal. They are scarcely ever found in the placenta, and it is generally useless to search for them there, they are somewhat more frequently found in the umblical cord cancetally in the fortal end of it.

If lettal death is not due to syphists the above signs are absent. The liver is small, soft, and dark red in colour. The spleen is not enlarged, and in the placents the characteristic appearances are absent. It may contain old clots in its substances, and there may be numerous red or white infarcts. These are usually present when the mother suffers from albumnums, but in that condition there is nothing character size in the appearance of the feetur or its organs. Retharce must be placed chiefly on the maternal history and on the olderntal absorances.

Occasionally the cause of antenatal death may be maternal diabetes, in which the fortal blood and unne may contain large amounts of sugar. In one case examined recently the percentage of sugar in the feetal blood equalled that in the mother, viz. over 450 migran per 100 e. or of blood

Other rare causes of feetal death may be absence or mal formation of organs such as the kidney or brain, abnormalities of the umbilical cord such as knots, excessive torsion, or localised constrictions, etc. etc

Examination of a Fresh Fostus

In the fresh foctus death has occurred during labour, usually from the effects of injuries received during birth. The method of examination is similar to that employed in the adult with the exception of the exposure of the crinial contents, which is best carried out as follows—An mession is made from a point slightly above and in front of the ear, across the cranial vault to a corresponding point on the other side and reaching down to the peneranium. The flaps so formed are stripped backwards and forwards as far as possible, thus exposing the sutures. The cavity is opened by cutting along the sutures with sharp-pointed scissors, care being taken not to injure the brain beneath. The frontal and parietal bones on each side are now turned down like the petals of a rose, this being facilitated by notching each bone slightly at its base with the existors.

After the cavity is thus opened, the presence of blood over the upper surfaces of the cerebral hemispheres is sought for Next the dural septa are examined for tears. The latter are most frequently present in the tentorium cerebelli, which may be seen by gently visuog the occapital lobes of the brain These tentorial tears may be complete, namely involve both layers, or uncomplete, moloving only one layer, usually the upper. Occasionally the tear may be so deep as to extend into the straight smus, when the fosses of the skull will be filled with blood. These tears of the septa are most likely to be found in cases of breich delivery. They may also be present, although less frequently, an the false cerebra.

The brain should now be examined for the presence of hamorrhages, which may be found in the following situations —

- (t) Diffusely over the upper surfaces of the cerebral hemi spheres, or there may be localised clots in the same situation
 - (2) Overlying the corpus callosum
 - (3) Underlying the temporo sphenoidal lobes
- (4) Underneath the occupital lobes, and overlying the tentorium cerebelli
- (5) Underneath the tentorium cerebelli, and between it and the cerebellim
- (6) Diffusely over the base of the brain—usually in severe injuries, as eg to the straight sinus
- (7) In one or both lateral ventricles, or more rarely in the third or fourth ventricles

Hemorthage in the lateral ventricles is frequently present in premature infants, even when the labour has been easy and natural, and should always be sought for The clot may be of the size of the little finger, distending one or both ventricles.

Probably the most frequent cause of death occurring during labour is, however, not cerebral harmorthages but asylogian II may arise from prolapse of the cord, from pressure on the cord during breech delivery, or samply from a prolonged second stage of labour leading to parallysis of the respiratory center. The sames to be looked for are as follows—

- (1) External Post mortem rigidity is absent, the body is livid, and there may be subconjunctional hamorrhages
- (2) Internal There may be excess of fluid in the pleural cavities, subepicardial and subpleural himmorrhages are inequently, though by no means invariably, found, the blood is fluid and unusually dark in colour, and the organs, especially the liver, are much congested, while the right heart is engorged with dark fluid blood. Punctate himmorrhages may also be found in the thymus, on the upper surface of the diaphragm, and in the partial pleure.

It is important to note that these punctate hamorrhages may be entirely absent in cases of asphysia Other causes of death may be found in the abdomen, for example, hemorrhage into the suprarenal capsule, or underneath the capsule of the liver. Either of these hematomata may occasionally rupture into the peritoneal cavity. Very rarely rupture of the liver may be found with fatal intra peritoneal hemorrhage, especially in premature infants, from awkward attempts at artificial respiration.

All the injuries above mentioned are most frequently found in difficult forceps or in breech deliveries

Finally a look-out should be kept for developmental abnormalities which may have been incompatible with postnatal life, as absence of both kidneys, congenital diaphragmatic herms, general foctal dropsy, etc

Neo natal Death

By neo natal death is meant death occurring during the first month after birth. It may be due to injuries received during birth, eg cerebral or suprarenal hæmorrhage. The writer has known an infant live for sixteen days with large clots in both lateral ventricles. The commonest cause of neonatal death, however, is catarrhal pneumonia, which accounts for about 40 per cent of the total Syphilis is one of the rarer causes of neo nataldeath The infant is not infrequently premature, is usually marasmic if it has lived long enough, and may show other external signs of syphilis, such as a bullous eruption on the hands and feet Internal examination may show the characteristic enlargement of the liver and spleen above referred to, but it cannot be too strongly emphasised that a normal sized liver and spleen do not necessarily exclude syphilis In the lungs there may be interstitial pneumonia, but the latter may be present without showing any very marked evidences on naked-eye examination In all cases where syphilis is suspected great help will be obtained in diagnosis from histological examination of the organs. especially liver, lung, thyroid, and pancreas, as well as the placenta. The changes found are of a chronic inflammatory nature, and have been described elsewhere (see pp. 239, 170, etc.)

Prematurity alone as sometimes the only cause of neo natal death found. At autopsy the longs may be found more or less completely unexpanded, and are not infrequently the seat of catarrhal pneumonia—probably a contributory cause of death. In such cases it is important, from the point of view of practical obstetries, to find the cause of the premature labour. Generally spacking an infant born before the thirty-aixth week of intra uterne lief has a poor chance of survey, although its chances naturally vary with the surroundings and the care and attenuous that can be bestowed upon it.

Points of Medico-legal Importance in the Examination of the Bodies of newly born Infants

In performing sectios upon newly born children the questions which require answering are -

- Yas the child viable? se was development sufficiently far advanced for the child to be able to live apart from the mother?
- 2 Did the child actually live (se breathe) either during or after birth?
 - 3 If the child lived, what was the cause of its death?

In order to be able to answer these questions the points of chief importance to note are —

External Examination—Note the length of body, weight, the condition of the finger nails, the presence of the testicles in the scrotum, the presence or absence of a capiti succedanum (the presence of such indicating that the blood was remaining during burth) and head modular

The condition of the umbaheal cord, whether cut or torn, and whether any evidence of a line of separation having formed

SD	Centres of Ossifica ton present.	Manubrum, Os calcis, Bodies and laminæ of sacraí verte- bræ,	First piece of body of ster- num Astraga- lus	Second piece of body of ster- num.	Lover epiphysis offemur. Third and fourth piece of body of sternum. Cuboid. Tist coccygeal ver- tebra.
Table showing the principal developmental Changes in the Fotus (Luff, slightly modified).	Testicles.	In abdominal cavity im- mediately be- low kidney	Near abdominal	In inguinal canals or upper part of scrotum, es- pecially left testicle.	In scrotum.
	Nada	Just forming.	Finger nails not reached ex- tremities of fingers	Reached ex- tremties of fingers and nearly ex- tremties of toes	Project beyond typs of fingers and reach ends of toes.
	Papillary Membrane	Present.	Beginning to disappear	Disappeared	Disappeared.
	E) elids	Adherent	Non-adherent	Non adherent	Non adherent
	Weight in Pounds.	1.3	*	20	5 8 Average 64
TABLE	Length in Inches.	52.6	12 15	15-18	18 10
	Month	6th	ą.	8th	gth

The presence of vermx caseasa, blood and injuries to the skin

The neck should especially be observed for abrasions

The mouth and nostrils should be inspected for the presence of froth or any obstructing body

Internal Francisco Attention should be first con-

Internal Examination—Attention should be first concentrated upon the air passages and lings in order to determine the question, Has the child breathed?

The trachea should be opened and carefully examined for the presence of froth. Some authorities recommend the tying of the trachea before opening the thorax. This is not necessary

After opening the thorax, the contents of the thoracic cavity—lungs, heart and thymis gland—are removed and placed entire in a poil of water. If the whole mass floats, there can be no further doubt about the question of the child having breathed. Should the organs sink, then the individual lungs should be carefully examined as to the presence of any motified areas that would undicate partial neration. The organs should then be cot up and the separate portions tested as to their capacity to float. It may be advisable in some cases to examine portions of the organs increased polytopic of the organs increased polytopic.

Thereafter the examination proceeds in the usual manner, attention being, however, specially directed to the presence of are in the thomach and small intestine as condisive evidence of breating, also to the presence of food in the stomach as evidence of the child having survived its birth for some time.

In all cases the presence or absence of an oxysic node at the lower end of the femur must be determined in connection with the conclusion as to the stage of maturity attained (see table, p 391). For this purpose the cartilage of the epiphysical should be done away in this layers. This should be done until

the diaphysis is reached in order to be quite certain as to the presence or absence of such a node. Another important centre of ossification for purposes of determining the stage of maturity reached by the child is that of the cuboid (see table, p 391)

The common causes of death in the new born child are as follows --

- r Compression of the umbilical cord
- 2 Protracted delivery
- 3 Malnutration and immaturity
- 4 Hæmorrhage from the cord 5 Fracture, usually of bones of skull
 - 6 Accidental asphysia
 - 7. Congenital malformation or disease

Among the modes by which death may be caused in cases of infanticide are the following —

- r Suffocation
- 2 Strangulation
- 3 Drowning
- 4 Fracture of skull
- 5 Exposure and neglect.6 Hæmorrhage from the cord.

Transcrinage from the cords

POST MORTEM CHANGES PRODUCED BY POISONS As stated elsewhere (p 24), in cases of poisoning or sus

As stated eisewhere (p 24), in cases of poisoning of suspected poisoning, after examination of the lips and mouth, the tongue, together with the fauces, esophagus, stomach, and duodenium, should be removed and examined in continuity

It should be carefully borne in mind that with certain exceptions the appearances in cases of possoning are by no means characteristic. There may be nothing at all in the alimentary tract to suggest possoning. Hence the necessity in all suspicious cases for the preservation of the organs and stomach contents for subsequent chemical analysis

Appearances in Poisoning with Corrosives -In all such cases there is softening of the ussues of the upper alimentary tract-lips, mouth, resophagus and stomach Sometimes there is necrosis of the superficial layers of viscera. The stomach shows swelling and contraction of its walls, extravasation of blood, which under the influence of the acid becomes black. ulceration, and sametimes perforation. The lining shows in some cases a characteristic colouring, e.g. in the case of nitric acid a vellow colour The appearances in sulphuric and hydrochloric acid poisoning are very similar and cannot in many cases be differentiated. The only point of distinction is that sulphurse is a stronger acid than hydrochlone, hence the corrosion is more intense and there is a greater tendency to perforation . the appearances varying, however, according to the dilution of the poison The mucous membrane may be charred to a dark brown or black colour, or the appearances may be merely those of an intense gastritis. In poisoning with carbolic, if the acid has been taken in a concentrated form, there is necrosis of the mucous membrane particularly of the stomach with the formation of a putty-like layer If the acid has been dilute, the interior of the stomach is dusky red from hypersemia

In the case of exalte each three are as a rule no external appearances. When the acid has been taken in the content totaled form there is a whitshappearance of the mucossmembrane inside the menth. When dilute, the appearances are those of irritation, vic confession.

In posoning with couste alkalies the appearances are somewhat similar to those found in the case of acids, but the issues has a characteristic soapy first. In ammonia pointning, in addition to the appearances of corrosion in the alimentary tract, there is generally acute inflammation in the air-passages

Appearances in Irritant Polsoning —The common straint possons, such as arsense, antimony, mercary, produce changes which do not differ to any extent from one another. By the mere naked eye examination of the parts beyond the fact that the appearances may be those of acute gastrius and enteritis, there is little that is characteristic. In some instances, ee in when the poision has been taken in a concentrated form, there may be little to suggest that the case is one of poisoning As a rule, however, the mucous membrane of the alimentary conclusion and in its upper part is sweller and in pairs hyperemic in other words, the appearances are those of gastro-enterits Occasionally there is subceration

In the case of phosphorus possening, in addition to the evidence of irritation in the alimentary tract, there is extreme fatty change in the liter (which is of a bright yellow colour) also in the kidney and heart. Such cases have to be distinguished from acute yellow atrophy of the liver (see p 23%), severe anximisa, and toxemisa. The distinction can, of course, be readily made on carrying out a chemical analysis of the organs.

Appearances in Poisoning with Gases —In poisoning with carbon dioxide the appearances are merely those of suffocation. The face, line, and ears have a dark purple colour.

The appearances in carbon monoxide (carbonic oxide) poisoning are as a rule typical Externally, the post mortem involvity is of a pink or light red colour and the same colour can often be seen in the lips, conjunctive, and nails Internally, while the blood in bulk may show no change yet wherever it is in a thin layer e g the mesontery etc, the pink or light red colour is most striking. The liver, spleen, kidneys and other organs frequently show the same change of colour

A simple but effective test can be carried out as follows — Take two test tubes partly filled with tap water, add to one a few drops of normal blood and to the other a few drops of blood from the body which is being examined. Normal blood when dilated in this way will always give a yellow colour Blood containing carbonic oxide, on the other hand, however much it is diluted, will always be finite.

A conclusive diagnosis can be made chemically as follows— A small quantity of normal blood is placed in a test inbe and diluted with three or four times the amount of tap water. A small quintity of blood from the case under investigation is smaller present to the control of times the discussion to make the control of the control of the case of the normalization to that test tubes and shake. In the case of the normalization to characteristic or prespirate will form. Should the blood from the case contain carbon monorate the preceptate will be a

In poisoning with ammonia gas there is intense inflammation in the respiratory passages

In poisoning with alkalods, such as morphine, sirychnine, etc., there is usually absolutely no abnormality visible Occasionally tablets of the poison are found in the stomach.

Occasionally tablets of the poison are found in the stomach.

In cyanide poisoning the characteristic odour may be observed by those with a trained sense of smell Similarly in poisoning with chloral, sulphonal and chloroform

The appearances in cases of vegetable poisoning are in no case very characteristic. Search should be made in the intestinal tract for the presence of seeds, leaves, or other evidence of vegetable tissue.

In cases of meat poisoning, cultures should be made from the intestinal contents and from the splten. Blood should be removed in order to test the serum against various microoreanisms for the presence of specific agglutinins (see p. 457).

SPECIMEN POST MORTEM REPORTS

The following are typical post mortem reports in the form in which they should be sent to the Procurator Fiscal —

A

EDINBURGH, 4th June 1909

We hereby certify on soul and conscience, that by instructions of the Procurator Fiscal of the County of Midlothian, on

SATURDAY, 3rd June 1909.

in the Mortuary of Edinburgh Castle, we examined the body of a man which was identified in our presence by

Sergeant TOHN SMITH.

and by one of us,

Captain JONES, RAM C.,

as that of

Private JAMES SCOTT

The body was that of a well built muscular man, 70% inches in height, and apparently about thirty five years of age. The body showed no signs of puttefaction, and the usual post mortem rigidity and lividity were present.

Situated on the right side of the chest, and in a line drawn between the junction of the collar bone and breast bone above and the right inpole below, there was a linear wound one and a half inches in length, the edges of which had been brought together by means of three stuckes. The upper extremity of this wound was distant one and a half inches and the bone and the was distant one and a half inches and the bone and two and a quarter inches from the middle line of the body. This wound was found, in the first instance by means of a bluint probe, and subsequently, during the course of the dissection to proceed obbquely through the second intercostal space downwards, duadwards, and dowards the left sude, and 'tri pass through the upper lobe of the right long near its anterior

margin, into the pencardium, and finally to enter the right auricle of the heart above the auricular appendage and close to the junction of the superior vena cara with the auricle. The length of the wounds in the long and pencardium was one inch, and that in the souncle bull an inch.

With the exception of the injury above described, the body presented no marks of external violence

The right pleural cavity was full of coagulated blood. The right lung was collapsed and bloodless The left lung was healthy The heart contamed some coagulated blood, and with the exception of the wound in the right auricle, was normal

The liver, spleen, kidneys, and other abdominal organs presented normal appearances

The stomach contained a quantity of green bilious fluid Its mucous membrane was in the condition of chronic entairth

The mouth, upper air passages and trachea were bealthy

The brain and its membranes were congested, but other wise they were normal.

From the foregoing examination we are of opinion that death was due to loss of blood from a wound of the heart produced by a sharp, pointed instrument.

> Signed by the two medical men present at the post mortem

> > В

EDINBURGH, 21st May 1897

We hereby certify upon soul and conscience, that we jesterday,

THURSDAY, 2014 May 1897,

examined, in the Royal Infirmary, the body of a man, which was identified in our presence by

the Wife of the deceased, by a Pohce Constable, and by the House Surgeon attending the case,

as that of

THOMAS ROBINSON.

Deceased was an able bodied person, apparently about sixty years of age. The only mark of violence observable was a lacerated wound of the nose, situated on the prominence, and about a quarter of an inch in length. Its edges were somewhat swollen and gaping. It was partially covered with a soft seab. The root of the nose was also somewhat swollen.

The various cavities and their contents were carefully examined, but with the exception of marked congestion of the spinal cord, and the effects of the wear and tear of life, nothing unusual was detected.

Portions of the heart, liver, and kidneys were subjected to examination by the microscope They were all more or less fatty, but not to a great extent

We are of opinion that the cause of death in this case was acute congestion of the spinal cord, such as we are conversant with in fatal cases of Tetanus

> Signed by the two medical men present at the post mortem,

APPENDIX A

TREATMENT OF SPECIMENS FOR MOUNTING

Fixatives -In many cases the pathologist will meet with specimens which he wishes to preserve for purposes of further examination, reference, or teaching It is his object to keep, as far as possible, the form of the organ or part and its natural colour. For this purpose the tissue must be fixed. The best all round fixative is certainly formalin, but by itself it does not penetrate well, and the colour is not well preserved. Salts of various kinds should be mixed with it. The resulting fluids are variously known as Pick's, Tores's, and Kaiserling's solutions. The formulæ for making up these are given on pp 404 5 Of the three, probably Pick's solution costs least to prepare There is, however, little to choose between them as regards results. The explanation underlying the preservation of the colour of the organ in the case of all three is as follows: the oxybemoglobin is transformed by the formalin into acid hamatin which has a brown colour; this, under the influence of the alcohol, becomes alkaline harmatin. which has a bright red colour sn like the original oxyhæmoglobin that the natural colour appears to have returned

Method of preparing Specimens—The specimen is placed in this fluid after having been cut open, or after having the fluid injected into it, the object being to secure the penetration of the organ or part by the fluid so as to prevent subsequent shrinkage or deformity Specimens are treated differently according to their nature and consistence. It should always be remembered that a large excess of fluid is necessary for proper fixation.

401

Solid Organs — There are two ways of dealing with solid organs, such as liver and spleen, if it is desired to present organs who as liver and spleen, if it is desired to present the organ whole. Fustive must either be injected into the man vessel—on the case of the liver, the portal term—orbiful of the fluid is injected here and there into the substance of the organ with a syringe

In most cases at as not necessary to preserve the wholeorgan, in which case the best way is to cut into a sense
of parallel shees about an inch thick. In the case of the kidney
it is sufficient to open up the organ in the usual way. The
brain is best injected through the large arreres at the base,
in the case of superficial endudies in the meninges or else
where some stronger formalin may be sincared over the
surface so as at once to fix the material. When dealing with
large tumours, it is well to inject fluid with a syringe here and
there, more especially in the hofer parts.

Groups of Organs,—When dealing with a group of organs, it may be necessary to fix them prior to removal. This can be done by injecting fixative into the circulation through one of the carolist or into a main vessel going to the part.

Lings —In the case of the lungs, it is best to inject the didd into the bronchs, and, in addition, into any cavity or area of softening, before opening up the organs. If they have already been opened, it is usually sufficient to immerse each half in fixative.

Cysts —When dealing with cysts, such as hydronephrosis, pyonephrosis, hydatid cysts, etc., the greater part of the fluid in the cyst should be removed with a syringe and replaced by fixative.

Interime -- Porsions of the intestine should either be uponed up, washed, laid filst or pinned out filst, and immersed in finance, or they may be sushed out by running water through them, then, having tied one end, finance is poured in at the upper end, the upper end ned, and the whole immersed in final. This latter method is more especially adapted to the preservation of timours, the bowel being subsequently shi up into two halves, as has been done in the care of Fig. 69.

Time necessary for Firstion —As regards the time during which specimens should remain in the fivative, this depends upon their size and consistence. Thin tissues, such as

intestines treated as above, are fixed in twenty four hours Lings injected through the broacht, and brains injected through their vessels, will be fixed sufficiently for cutting in forty-eight hours. It is necessary, bowever, to leave the slices some time longer in the fixative. For more solid organs, such as hver, kidney, spleen, or heart, ten days to three weeks will usually suffice, but the specimens take no harm from remaining considerably longer. A good test as to whether or no an organ is fixed is to squeeze it. If red blood exude it is well to leave the specimen some time longer. Another test is, of course, the consistence of the organ. As a rule, so long as it is soft, further fixation is required.

Mounting Fintd —When properly fixed, the organ is washed in clean water for some minutes and placed over night in methylated spirit, which may have been previously used. It is then placed in fresh, clean spirit, until the colour has returned, a few hours is usually sufficient. The specimen is then washed again in running water for a few minutes, and placed in the following fluid.

Glycerine (pure) . I part
Water . 2 parts

To each Winchester quart of the above, I fluid on of formalin (460 per cent) is added, also I or of a saturated solution of pure potassium acetate. The object of the formalin is to prevent the growth of mould. This fluid should be changed once or twice, and when the specimen is finally mounted in a glass jur, the same fluid should be filtered in In such a fluid a specimen will remain soft and retain its natural colour for many years. Care should, however, be taken not to expose the specimen to direct sunlight, otherwise fading of the colour will occur.

Mounting—When selecting a jar for permanent mounting, the nature and size of the specimen will, of course, be taken into consideration. As a rule, the rectangular glass jars are the best, the specimen being fixed to one side of the jar by means of a little gelatine, or secured to a plate of glass with strong thread. Whole bearts and spleens are best suspended in round jars. Forcase of mesches tand oppen can.

be stretched upon sheets of glass or mica, or within a frame formed of a bent glass rod. The interior of cavities and the surfaces of organs are best coated with gelatine fluid, which is prepared as follows, in order to prevent portions coming away and producing turbidity—

100 graios pure gelatine

800 c.c. thymol water (saturated in the cold)

200 CC, glycenne

This is gently heated until the gelatine melt: A few drops of actic acid are added, and the whole is clarified with whiten of egg. The gelatine is poured upon the specimen white warm and fluid and allowed to solidily before the specimen is mounted. For fixing on the cover of the jar the best medium is a muture of lithings and Archangel tan in quantities unflictent to make a thick paste. A band of Berlin black should then be painted round the margin of the cover.

Summary of Steps in Treatment of Specimens for Mounting

1. Place in Pick's, Jores's, or Kaizerling's fixative (for composition see below) for a variable period depending upon site, consistence, etc., of specimen

2. Wash in clean water for some minutes.

- 3 Place overnight in methylated spirit which has been previously used.
- 4 Transfer to fresh spirit for a few hours until colour returns
 - 5. Wash in running water for a few minutes.
- 6 Place in glycerne and water (one part of the former to two of the latter), to which potassium acetate (1 ounce sat solt to Winchester quart) is added, also formalin to prevent the growth of moulds

7. Mount in fresh fluid of similar composition,

Picks Fisative

Formalia	(pure,	íe	40 per	cent	. (•	50 C.C.
Anthoral	Carlsba	ıd s	alt		-		50 grm.
Distilled	water						I litre

The Carlsbad salt is prepared by mixing Sod sulphate 22 parts, Sod. bicarb 18 parts, Sod chloride 9 parts, Pot sulphate 1 part. The last ingredient is not essential.

		Kasse	rling	s Fix	atsve		
Formalin							100-200 C.C.
Pot nitrate							15 gm
Pot, acetate							30 grm.
Water	•	•					I litre.
		Jo	res's i	Fixati	ve		
Formalin	•	٠	•	•	•	•	50-100 C.C.

In each case to obtain the best results the formalin used should be Schering's — It costs about twice the price of the ordinary commercial formalin, but it is greatly superior in quality

The salts for the various fixatives may be made up in packets and mixed with the water and formalin as required.

In the case of each of the methods, after fixation is complete the specimen is transferred to methylated spirit in which the acid hæmatin hecomes alkaline and the colour thus returns to the blood in the tissue

After twenty four hours in spirit the specimen is placed in step interpretative which in each instance contains glycerine as its principal ingredient. As a rule the glycerine is diluted with double the quantity of water to which potassium accent (in the case of Pick's and Kauserline's method) is added.

Mr. R. Frost of Sheffield (Proc. Path Soc Great Britain and Ireland, Jan. 1912) has proposed the following as a preserving medium —

Sod fluoride				80 grm
Chloral hydrate				80 grm
Pot. acetate				160 grm.
Cane sugar (Tat	te's c	ube)		3500 grm
Thymol water (s	satura	ited)		8 litres.

The chief advantage of this medium is its cheapness

TREATMENT OF TIESUES FOR MICROSCOPIO PURPOSES

Necessity for Routine Microscopic Examinations

For a complete unestigation of a fatal case of disease, it is nocessary not only to examine as many parts of the body at possible with the unaided eye, but to investigate them further by means of the meteroscope. This rotatine examination of the organs unicroscopically cannot be too strongly instited upon. Where only spectimens of exceptional interest say put through and cut, the pathologist will never be able to acquire skill in differentiating the finer shades of pathologists change. Further, diseased tissues do not always bear their secrets stamped upon them plantly, and unless a microscopic examination is carried out as a matter of routine, much thit is of exceptional interest will be lost.

Selection of Portions of Organs or Tissues

As regards selection of a portion of a diseased organ, no definite rules can be laid down it is well not to be atsisfied with a single portion, but to take several pieces from different parts Where one is dealing with a tumour, one section should include the capsule or a portion of any invaded tissue. If the tumour be in the bowel, along with the portion should be taken a piece of the normal gut wall. In the case of swo organs as kidney, liver, and spleen, one section at any rate should include the capsule. Sections of the kidney should of course include both cortex and medulla

It is not at all a bod plan to cut the different organs in different ways, or at any rate to pare them down to different shapes after they have been passed into spirit. Thus, kidney may be cut as a trangle, the base being the capivale, here cut in sequence, and spleen in the form of a rectangle. The advantage of this method is that afterwards, been the tissues are being passed through the sarrour reagents and also when in paraffin, they may be recognised at a glance.

In any case, the section of the organ should be thin. It

cannot well be too thin A good average thickness, except for certain purposes, is \(\frac{1}{2} \) meh. In the case of tissue which is to be fixed in such mixtures as Flemming's or Marchi's still thinner sections are required. This does not mean that the pieces of tissue must not be large. As a matter of fact, it is most advantageous to have large sections, although they are much more difficult to cut with the microtome. In the case of lung preparations, it may be safely said that the sections cannot be too large. It is exceedingly difficult, in not im possible, to judge of the nature and distribution of pulmonary diseases from a minote portion of limp taken out at random as minote portion of limp taken out at random.

These statements do not apply to sections for all purposes When examining minute changes by serial sections, it is well to have small pieces for cutting, because it is obviously much more easy to find corresponding areas in the sections above and below any given point if the portion of tissue is minute.

When dealing with portions of the bowel, it is well to pin out a fairly large area of meetine upon a small block of wood and immerse both in the fixative. Subsequently, smaller portions may be cut or singped out. For any of the above purposes a sharp scaled or raror is required. In certain cases it may be advisable to fix the specimen entire before cutting away any portion for microscopic examination. This par ticularly applies to tumours of the stomach and bowel. In any case, it never spouls a specimen neatly to cut out a small puece for microscopic purposes.

It is well at the same time as one takes the sections to make a note of any matter of importance upon the label of the bottle in which the tissues are to be placed, such as the part of the organ from which the specimen was taken Instead of pasting it on the bottle, the label written in peaci may be placed inside the bottle along with the specimens

Fixation of Tissue

It is impossible to cut in the fresh condition sections of organs thin enough for microscopic purposes Parenchy mations cells and softer parts fall out, leaving a mere skeletion of through these A in necessary theoretone, in the

first place, to fix the tissue. There are many fixatives for tissues, but for ordinary purposes to per cent formabn (te 10 per cent of the commercial 40 per cent formaldehyde) is probably the best. It is readily procured and made up. penetrates well, and gives excellent results. For this purpose undoubtedly Schenny a formalin is the best. With other brands. costing less, precipitates are very apt to form, especially in tissues containing much blood. For certain purposes other fixatives may be employed and as a matter of fact, when dealing with cases of special interest, it is well to use more than one fixative. One of the advantages of formula is that other methods of fixation can be employed subsequently, such as bichromate of potash and osmic acid, another is that sections can be placed in gum, frozen, and cut directly from the formula solution. As in all methods of fixation, it is essential to have plenty of fluid-at least twenty volumes of fluid to one of tissue.

Treatment of Tissue for cutting in Gum

Suitable portions of itssue are placed in the 10 per cent formalin, and are left for twenty four hours. In the case of thick pieces, it is well to leave them longer. At the end of that time, if a rapid disgnoss is required or if it is necessary to stain for the presence of 1st, pieces of the organic and be transferred directly from the formalin to a gum solution made up as follows:

Gum Arabic 1 part, Water 3 paris, Thrmol a few crystals.

and subsequently frozen and cut.

Although good results are obtained by cutting directly after fixation in formalin it is better to harden in spirit for 24 hours or longer, to wash out the spirit in running water overnight, and subsequently to place in gum solution for some hours.

Other Methods of Fixation

i For the brain, cord, or other portion of the nervous system, where it is desired to preserve the myelin sheath of

the nerve elements, it is necessary to fix the myelm substance by bichromate of potassium or other similar salt. For this purpose, Muller's flind is as good as many others of more recent introduction. It is made up as follows—

Bichromate of potassi	um.		2 5 grm.
Sulphate of sodium			ı gım.
Water			TOO C.C.

The sodium sulphate of the Muller's fluid may, according to Mann, be omitted without the solution suffering as a fixative

Fortuna of brain or cord may be placed in this direct or, better, transferred to it from formain. They should be left in the fluid for six to eight weeks, washed thoroughly in running water for some hours, and transferred first to 50 per cent, spirit, then 25 per cent, hastly pure spirit. The bichromate fluid should be changed frequently during the process of fixation. The process can be hastened considerably by placing the fixative containing the pieces of cord in the incubator at 37° C

Although tedious, the above method gives very good results, even with specimens which have to be stained with ordinary methods. Muller's fluid also forms the haiss of a number of other fixation methods, so that it is advisable to keep it in considerable quantity in stock.

2 Zenker's Fluid.—This can be made from Muller's fluid by adding corrosive sublimate, 5 grams, and glacial acetic adding corrosive sublimate, 5 grams, and glacial acetic as required to the quantity of stock solution used, as it reaches early evaporates if kept. The tissues should be fixed in the aboves for twelve to twenty four hours. At the end of that time when in running water for some hours and place in methylated spirit till required.

This is an exceedingly good method of fixation for most purposes. The solution penetrates well and preserves nuclear structure admirably. One objection which it has in common with all mercury fixatives is that the mercury becomes precipitated in the tissues. This can be removed by means of todine, which forms with it a colourless soluble compound. The todine may be added to the spirit in which the tissues are preserved, or, what is a better way, the sections may be treated with Lugol's fluid (see p. 432) or a 1 per cent alcohol'c solution of todine for ten to twenty minutes before staining, followed by treatment with spirit to remove the todine

- 3 Orths Fluid—This is simply Miller's fluid in which to ec pure commercial formalin is added to the too ec. The formaldehyde should be added immediately before the fixat the is used. Fixation is complete in three to four days. The specimens are afterwards washed in running water, and placed in methylated spirit. Mallowy states that the addition of 5 per cent accute acid improves the fluid. The fluid is an excellent fixative for most purposes.
- A. March's Final.—This is Muller's fluid two parts, to osmic acid (f per cent aqueous solution) one part. As in the case of all osmic and fixatives the sections should be very thin They should remain in the fluid three days protected from light. They are afterwards washed in running water and hardened in spirit. The method is specially applicable to the demonstration of recent areas and tractics of deveneration in the sinual

cord and brain (see p 438).

5 Flemmine's solution is made up as follows ---

Osmic acid 2 per cent aqueous solution . 4 parts
Chromic acid 1 per cent , , , 15 ,,
Glacial acetic acid . 1 part.

The portions of tissue should be exceedingly thin, as the osmic acid peneirates brilly. They are left in the fluid for one to three days in the dark, subsequently washed in water, and hardened in spirit. The method is specially applicable to the study of nuclear changes, and to the demonstration of clein fats.

6 Corrouve unblusate, a saturated solution in normal saintee with, if desired, the addition of p per cent glacial actic and. The tissues are fixed for twite to twenty four hours, washed thoroughly in water and hardered in apart. This san exceedingly good all round fixative. More especially is it demonstrate granules in the leucocytes and other cells. The same objection as in the case of Cenker's fluid holds good with corrosse sublimate. The sections must be treated with ode ne before staining in order to deside, the mercury.

7 Absolute alcohol and methylated shrit are both fixs tuves as well as hardening agents. Under their influence, however, the tissues and cell elements tend to shrink consider ably. They are said to be specially good for tissues in which it is desired to demonstrate bacteria. But as a matter of fact formalin and corrossive sublimate are equally as good.

It is always desirable to place a little cotton wool in the bottle in which the fixation is carried out, in order to prevent sections adhering to the bottom. It is also desirable, particularly when dealing with unconsolidated ling, to place some at the top, in order to prevent the pieces of insue from floating. Remember always to have a large excess of fluid present.

Sending Material to a Distance

The practitioner not infrequently desires to send pathological maternal to some institute or hospital where expert opinion and be obtained. For his purpose the best fluid in which to place the tissue is 10 per cent formalin. The pieces of issue should be small, and at least ten times as much fluid as tissue should be present in the bottle, otherwise penetration of the finance will be incomplete and putrefactive processes will progress In the absence of formalin, methylated spirit or absolute alcohol may be used

Treatment after Fixation

After fixation is complete, as a rule ii is advisable to wash the tissue in running water. This is absolutely necessary when fixatives, such as Zenker's, Orth's fluid, corrosive sublimate, Flemming's, have been used. It is not necessary in the case of formalin fixed tissue. The latter may be placed directly in methylated spirit.

Hardening—After fixation, or if necessary after fixation and washing, the tissue is placed in methylated spirit. This can be done by placing directly in commercial methylated spirit or by passing through dilutions (50 per cent and 70 per cent) first. For ordinary purposes the dilutions may be omitted, especially when one is dealing with material removed from the body twenty four or forty eight horos after death. When

it is desired to preserve the finer details, more especially when one is dealing with the central nervous system, then passage through the dilutions is advisable, as there will probably be somewhat less shrukage in the cell elements. In addition to hardening the specimen, the passage through spirit also to a certain extent delividrates

Dehydration.—The next process is dehydration, or the removal of all water from the tissue. Some tissues are more difficult to dehydrate than others. As a rule the denser the tissue the more difficult it is to dehydrate. For this reason any specimen containing well formed connective tissue requires longer than a specimen such as, for example, normal liver For purposes of dehydration it is well to use two changes of absolute alcohol. As a rule, a few bours in the first alcohol must be replaced by fresh after being used for a succession of specimens during a few days.

Embedding

The further treatment of the specimen depends upon whether one wishes to cut the sections in parafilio or celloidin In the case of most organi and trisices, it is necessary to impregnate with some substance which will hold together the cellular elements during the process of cuting and stating For this purpose, parafilio or celloidin is commonly employed. Each has its own special advantages, each therefore has its supporters. Probably parafilio is more generally used, so we shall consider in first.

Embedding in Partfin.—From the absolute alcohol, the sections are placed an eclearing flund, which may be chloroform, bennol, xylol or some such chemical substance, bennol being the cheapent of those mentioned. All these have this in common that they readily mix with alcohol on the one hand, and with partfin on the other. At least twenty four hours should be allowed for this cleaning process, and it is well to use two changes of the cleaning medium.

The sections should then be transferred to benzol, or what ever clearing agent is employed, to which some pieces of paraffin have been previously added, and the bottle placed on the top of the paraffin oven, or inside the incubator. At this temperature, which will be about 37° 40° C, henzol will, of course, take up much more paraffin From this mixture, at the end of twenty four hours, the pieces of tissue are placed in a shallow uncovered dish containing pure paraffin, in the interior of the paraffin oven. Here they remain until all the henzol has been driven off. If the sections are not too thick or if they are turned over at intervals, a few hours will suffice. It is important on the one hand not to leave the specimens too long, because the heat of the oven shrivels them other hand, it is necessary to drive off all the benzol, else the tissue will shrivel afterwards and will not cut well. As a rule, if they are placed in the pure paraffin (melting point 50° 53° C) the first thing in the morning, they may he cast the same day, some time during the afternoon. The criterion for the whole of the henzol having been driven off is the absence of the characteristic odour on shaking the dish containing the pieces of tissire.

To cast the specimens, two L-shaped moulds are placed upon a porcelain slab, so as to shut in a space the size of which will vary with the number and size of the specimens Melted parafin from a large dish is then poured in to the depth of about 1 centimetre, the specimens are transferred by means of a warm pair of forceps, and placed, according to the direction in which it is desired to cut them, in the fluid paraffin upon the porcelain slab. When the surface of the paraffin has solidified, slab, paraffin and moulds may he placed in cold water and the hlocks removed when solidification is complete

The above periods for dehydration, clearing, etc., may be considerably shortened if the specimens he small and thin Various abridged methods are in use, of which the following is a reliable one. At the same time, it must be remembered that lessurely methods give the best results.

Quick Method for embedding in Parafin (Mallory and Wright)—Small pieces of usene or organ are placed in two changes of acctone for half to two hours The acetone must be in large excess From this they are transferred to xylol or chloroform for fifteen to thirty minutes. They are then placed in pure melted paraffin for half an hour to an hour and a half at 57° C. Embed in paraffin

Summary of Method of embedding in Paraffin

Fixation in formalin for .	24	hours.
Hardening in spirit for at least	2.4	17
Absolute alcohol, two changes	24 48	**
Benzol, xylol, or chloroform, two		
changes	2.4	
Benzol, etc., saturated with paraffin		
at 37° C.	24	**
Pure paraffin, melting point 50" 53" C	6 12	

Outting Preparations embedded in Paraffin. -- For cutting sections embedded in paraffin, one of the improved rocking microtomes made by the Cambridge Scientific Instrument Company is probably the best. No special knife is required. Suitable razors are supplied by Hilliard, Edinburgh, for as, They must be kept in good order by frequent stropping and occasional setting on a Canadran hone. The block of paraffin. in which the specimen has been cast, is pared down to a convenient size with a penknife. It is fixed to one of the dies, which screws on to the arm of the microtome, by means of a heated piece of metal-the end of a copper section lifter will do admirably The screw regulating the thickness of the section is adjusted to the desired position (about to microns). and a number of sections are cut. These can be lifted by means of a fine-pointed pair of forceps and a small brush, and placed in warm water about 44° C. When the sections have flattened out they are mounted singly, or, if desired, in a series, on a clean slide. Slides previously smeared with albumin (egg albumin in water) have this advantage, that the sections adhere to them more firmly. The slide, or series of slides is then placed in a slanting position till dry. They are then placed on the top of, or so, the paraffin bath, or in an incubator at 37° C.

Embedding in Gelloidia.—The sections are taken from absolute alcohol and placed for twenty four hours in a mixture of equal parts of absolute alcohol and ether. From this they are transferred to a dilute solution (2 per cent) of celloidin (Schenne's granular) in equal parts of alcohol and ether

They may be left in this for twenty four hours or longer, and at the end of that time are transferred to a 6 per cent solution of the same material. Here they remain for twenty four hours more

To cast the specimens, take a cube of wood of a suitable size. Pour a little celloidin over the cross grained surface. then place the specimen on it and pour a little more over Allow the whole to dry till it is of a firm consistence, then place in 85 per cent metbylated spirit.

The celloidin method of embedding is more especially used for sections of the brain, spinal cord, bone, and skin, but it is applicable to all types of tissue Its chief advantage is, that during the process of impregnating the specimen with the celloidin no heat is applied. Another advantage which it has over the paraffin method is that the sections are floated in the staining fluids and not fixed to slide or cover glass. This allows of the stain acting from two surfaces, and undoubtedly has the result of giving a more natural appearance to the tissue elements

Cutting Preparations embedded in Celloidin .- For cutting such preparations a number of microtomes are avail able Among them the Schanze, Minot, and, for large sections, the Bruce microtome are the best known Special knives are always supplied with these, which require great care in order to keep sharp

While cutting, the specimen and the knife are always kent moist with 80 per cent spirit, applied one or two drops at a time by means of a large hrush Serial sections may be obtained by placing the sections as they are cut upon tissue paper moistened with spirit. The sections are lifted with a brush, and placed in 80 per cent spirit until they must be stained. From this they are taken and either washed first or placed directly in the staining fluid

Cutting Sections in Gum -As previously stated, it is advisable to fix specimens before cutting them. It is possible, however, to obtain sections good enough for making a diagnosis, as, for instance, at an operation while the surgeon es waiting, by placing a small piece of tissue in gum and immediately cutting it. When such rapidity is not demanded, twenty four hours' fixation in 10 per cent formalin is sufficient, but where time permits, and when it is not desired subsequently

to stain for fat, it is well in addition to harden the tissue in spirit for a day or two This should not, of course, be done with sections which are subsequently to be stained for fat. At the end of that time the spirit should be washed out in running water over night, and the specimen placed in gum for some hours It is absolutely necessary to wash out the spirit thoroughly and to allow sufficient time for the gum to penetrate. Sections cut in this way give as good results as any when suitably stained For many tissues, notably lung, the results are as good as those obtained with the best celloidin sections, and the tissues are less subjected to the influence of chemicals, and in consequence are less shrunken. Further, very large sections can be obtained by freezing, the size only being limited by the aue of the freezing stage, and this, as has been already emphasised, is a matter of supreme import ance in studying lung disease. Formerly, when ice and salt had to be used for freezing, the method was clumsy Later, the introduction of other simplified the process, but in these days of liquid CO, no method of cutting sections is more simple or effective

With regard to the type of microtome, the Cathcart, with ether freezing, is a useful bitle instrument, particularly for travelling purposes, when the pathologist accompanies the

surgeon to an operation

For laboratory purposes undoubtedly one of the numerous CO, freezers is preferable, owing to its more rapid and more powerful action Of the more elaborate CO, microtomes, the Aschoff Becker is very good A simple one is that introduced

by Dr. Mixter, and used largely in America.

The piece of tissue is placed upon the stage of the nucrotome, and some cum poured on the top and round it The carbonic acid gas is then turned on and off a number of times till the specimen is opaque, white, and hard. In this condition the knife will not cut it, but when it is just commencing to thaw the best sections will be obtained. To prevent the deeper portions from thawing, the gas should be turned on every now and then A razor, the blade of a carpenter's smoothing plane, or one of the special knives supplied with the microtomes is used for cutting. The sections are removed with a brush and placed in a basin of cold water, where they will gradually flatten out. The sections may be stained at once, or presented in formalin water, or better, in spirit, for future use. When it is desired to stain fat, spirit cannot of course be used.

Decalerfleation

Tissues which contain bone or calcium salts, such as atheromatous patches in the aorta, calcaraous tuberculous glands, etc., require to be decalcified before being cut, otherwise the razor or kinfe employed will be runed Before decalcifying, the portion of bone or tissue is fixed, having been previously sawn or cut to the desired size. As fixture, formatin 10 per cent, Zenker's or Orth's fluid may be used. After washing, the specimen is placed in methylated spirit for at least twenty four hours.

There are many decalcifying fluids, the chief constituent being, in all cases, some and In order to ensure the penetra tion of the acid, the fluid should be frequently changed, and should be used in large quantity. Unfortunately, nucles are always damaged by such acids, so that the sections require to be stained for longer periods and never give quite such good results as tissues which are not so treated.

Nitric acid is one of the most effective decalcifying agents It is used in a 5 per cent aqueous solution. For rapidity of action Perenny's solution can be strongly recommended. It is made up as follows —

Nitric acid, 10 per cent		400 C.C.
Absolute alcohol		300 C.C.
Chromic acid. 1 per cent		300 C C

In the above solution decalcification is usually complete, if moderately thin pieces of tissue are used, in from ten to fourteen days

Apparatus required in Staining

As regards apparatus required, this depends upon the way in which the sections have been cut. Slides $3 \text{ in } \times t$ in for ordinary sections, and $3 \text{ in } \times t$ in for larger sections, as well as cover

glasses (No 1 and No. 2) will always be required. For sections cut frozen or in celloidin, a series of watch glasses to hold the staining fluids and reagents, a bowl of water for washing between the processes, needles for lifting the sections, dropbottles containing absolute alcohol and xylol, and a bottle of Canada balsam, also giveenne selly or Farrant's medium, are all that is required. In the case of sections cut in paraffin. these may have been mounted either upon cover glasses or on slides. In the former case, a series of drop-bottles containing the reagents and a pair of Cornet's forcers to hold the specimen are all that is necessary. In the latter case it is well to have a series of stoppered jars, of a size suitable for holding at least two slides, back to back, for stains and reagents A tap for cold water and a sink should be at hand. also a par containing distilled water. A pair of scales for weighing out stains is also necessary

For sections cut in celloidin, watch glasses or other small class dishes for the stains and reagents, and needles for lifting

the sections, are required.

Sindes and cover glases should always be clean; more especially they should be free from greate. The best way of securing this is to place them in strong hydrochloric and for a short time, then wash in running water, and finally put them into a jir with a properly fitting top containing methylated spirit. From this spirit they are taken and dried with a clean clean satisface are required.

Mounting Media

Canada Balsam — This is prepared by dissolving the balsam either in beniof or xylol. The solvent is added in sufficient quantity to give a yellow fluid with a tyrupy consistence. The balsam should be kept in one of the specially prepared stoped bottles. It is necessary to add a lattle of the solvent from time to time to replace that which evaporates.

In the case of tissues treated with osmic acid, chloroform should take the place of the henrol or xylol

Sections which have been stained in anilin does such as thionin tend to become discoloursed when mounted in ordinary balsam. This is due to the fact that ordinary halsam is acid

as a result of oxidation. In neutral balsam, which may be obtained from Grubler, Leiping, the colour is preserved for a much longer period. Another way of getting over the difficulty is to mount the section in Colophonium dissolved in terpentine oil.

Glycerine felly—This is specially useful in mounting sections which have been stained for fat or waxy material. It contains—

Gelatine (Coignet's)	30	parts.
Distilled water	70	21
Glycerne	100	**
Alcoholic solution of camphor	5	**

After standing overnight in the distilled water the gelatine and water are boiled and subsequently strained through a warm filter. The glycenne and camphor are added and mixed thoroughly. Before use the medium should be liquefied by being placed in warm water.

Farrant's Medium—Equal parts of water glycenne and a saturated watery solution of arsenious acid (saturated bohing) are mixed together thoroughly. To this is added about half its bulk of gum arabic. The mixture is stirred from time to time until solution is complete. It is then filtered and a little carbolic (1 20) added

STAINING METHODS

Treatment of Settomeaut in Parafin before Stamming—Before staming, sections which have been cut in parafin require to be treated with some solvent for parafin such as benzol or xylol. The reagent is dropped on to the section and the shde or cover glass gently titted backwards and forwards for some seconds. The benzol is then poured off and replaced by fresh The process of solution of the parafin may be hastened by warming the slide or cover glass very gently well above the flame of a bunsen until the parafin is seen to melt. The benzol is then poured on and allowed to remain for a few seconds.

The benzel must now be washed off by means of a few drops of methylated, upon, the clide being inclined in its to allow the fluid to run away. The section is now gently immersed in water and left for a few minutes before staining. The stain is then dropped or filtered on to the section, or the section and slide are placed in a suitable jar containing the stain.

Treatment of Sections cut in Celloudin and Gum —Sections cut in gum or in celloudin are taken direct from water by means of a needle and placed in the staining fluid, sistally in a watch glass or similar hollow dish. Such sections stain much more rapidly than those cut in parafilin, by reason of the fact that the stain scring upon the tissue from both sides penetrates now readily.

Picro-Carmina

This is a combined nuclear and protoplasmic stain. It also has the advantage of differentiating between vanous types of tissues and cells. The nucles of cells and fibrous tissue are stained brilliant crimson. Epithelial cells, necrotic material, fibrin and classic tissue are stained yellow. The stain is propered as follows:

Pure carmine . . 1 part.
Liq ammoniae fort. . 3 parts
Dist water . . . 3

Dissolve the stain in a test tube in the aimmonia and water and add 200 prits of a cold, saturated, and fiftered solution of piece acid, and mix thoroughly. Place the fluid in a basin covered with glass and allow to speps in direct simplifying testing its powers of staining from time to time. To prevent the piece acid crystallising out, add 10 to 20 per cent of distilled water to the fluid that remains. Add also 2 to drops of 1 to 20 carbolic to prevent the growth of fluid.

Method

Spread the section out on a cover glass, drain off super fluous water. Run several drops of staining fluid over and allow to stand for fifteen to twenty minutes. Drain off excess of stain. Do not wash. Mount in Farrant's medium.

The method is specially useful for sections cut in gum.

Hæmatoxylin (Hæmatein), Eosin

Hæmatoxylin is obtained from the wood of Hæmatoxylon cambechianum by extraction with ether It is not in itself a die but becomes one on oxidation In its oxidised form it is known as hæmatein Neither the original substance nor the oxidation product is capable of staining directly Each requires a mordant added to it or used separately As mordants, alum and iron are very commonly used

There are many useful methods for staining with hæma toxvlin and hæmatein. They all give very similar results, the

nuclei staining a dark blue or purple colour

Of the hæmatoxylin methods probably the best, both as regards ease of preparation of the stain and rapidity of action. is Weigert's iron hæmatoxylin

Weigert's Iron Hamalovylin -Two solutions are prepared, No 1 containing the hæmatoxylin, No 2 the mordant (iron) These solutions keep well separately For use, equal parts of the two are mixed together. The mixture will stain at once, hut is better after twenty four hours. It will keep good for eight to fourteen days

The solutions are made up as follows -

Solution 1

Hæmatoxylın t grm Alcohol of per cent . 100 CC

Solution 2

Liq ferri perchlor (SG 1 124) 4 C.C. Dist water 100 CC Hydrochloric acid (conc.) I C.C.

The mixture, which has a brownish black colour, is dropped on to the section and allowed to remain from one to five minutes. Better results are obtained by differentiation for one or two seconds in acid alcohol (1 per cent hydrochloric acid in methylated spirit) The section is then thoroughly well washed in tap water and counterstained with eosin or picro-fuchsin (wan, Greson's want)

An excellent hæmatem is that recommended by Mayer It is prepared as follows —

Hamatein - 1 gmm.
90 per cent alcohol - 50 cg.
Alum - 50 gmm.
Water - 1 litre

A crystal of thymol is added to prevent the growth of moulds. The humatein should be dissolved first in the alcohol by the aid of warmin, and then added to the water in which the alum has been already dissolved.

The stain improves on keeping. The ripening process is more ripul if the stain be exposed to sanight. At first it may require half an hour or even longer to stain, kiter, ten to fifteen minutes is sufficient. If the stain is too deep or too diffuse a few seconds in and alcohol (hydrochlone acid 1 per cent in methylated spirit) will differentiate. The section is then washed thoroughly in tap water until the blue colour returns

Method

- Stain in hematoxylin for two to five minutes or hæmatein ten to thirty minutes.
 - (2 Differentiate in acid alcohol if necessary)
 3 Wash thoroughly in water
- 4 Counterstain in 1 per cent watery cosin for one to four
 - 5 Wash in water
- b Dehydrate, and at the same time take out some of the ensit in absolute alcohol.
 - 7 Clear in benzol
 - 8 Mount in balsam
- In the case of sections cut in gum or in celloidin a much shorter period is required for staining in the hæmatein and cosin solutions.

Hæmatoxylin combined with Picro-fuchsin (van Gieson's stain)

For this combination the harmatoxylin or harmatein may be any of those in common use, such as the above mentioned, but it is necessary when using these with picro-fuchsin to stain for a longer period than when cosin is used, as the picric acid tends to decolourise the hæmatem. Another alternative is to use a stronger nuclear stain, and for this purpose Weigert's iron hæmatovylin bas no rival.

Van Greson's Solution —It is best to prepare a stock solution as follows .—

Acid fuchsin I 5 grm.
Saturated watery solution of picric
acid (about 0 6 per cent) I 50 c.c.

This solution keeps well For use, mix 1 c.c. of the stock solution with 10 c.c. saturated watery solution of picric acid. This solution will also keep for some weeks

Method.

- 1 Stain in iron hæmatoxylin for two to five minutes or in hæmatein for fifteen to thirty minutes
 - 2 Wash in water
 - 3 Stain in picro-fuchsin ten to thirty seconds.
 - 4 Wash rapidly in water
 - 5 Dehydrate rapidly in absolute alcohol 6 Clear in carbol xviol (or carbol benzol)

The advantages of the carbol sylol is that dehydration need nor he very complete if it is used. This is of importance because prolonged treatment in alcohol extracts the stain. The mixture consists of three parts sylol (or beniol) to one of melted crystalline carbolic and

- 7 Clear again in xylol (in order to get rid of the carbolic)
- 8 Mount in Canada balsam
- The special advantage of the van Gieson method is that a differentiation is effected between certain types of cells an insuses. Red blood corpuscles are staned a bright yellow colour, connective tissue fibres red, and muscle fibres yellow or brownish vellow.

In staining sections cut in guin or in celloidin with picrofuchsin a longer period of washing in water is required.

Eosin, Methylene Blue Staining Method

This is a method of very general applicability. In some schools in America it is used as the contine staming method,

It has many advantages. It is a funly sharp nuclear stain, but its their advantage is as a stain for protoplasm. The structure of the protoplasm more particularly my granules which it my contain, are brought out with the characteristic reaction to the acid (esoin) and basic (methylarie blue) dyes. The outline of the individual cells will be brought out very clearly and their relative size thus more easily estimated. Moreover, any bicteria present will be stained with the methylere blue.

In order to get the best results the ussue should be fixed in Zenker's fluid or in saturated corrossic sublimate Fairly good results will, however, be obtained with formalin fixed tissue.

Method -A simple method of using the stains is as follows -

1 Stain in cosin (2 per cent aq solution) five to ten

- minutes

 2 Wash in water

 3 Stain in methylene blue (t per cent ag solution) half
- minute
 - 4 Wash in water

 Differentiate and dehadrate in absolute alcohol.
 - 6 Clear in aylol or bensol and mount in balsam.

After staining with the cosin, Potas, Alum (sat sol) may be used for fixing the stain

The differentiation should be carefully carried out and controlled by putting the section under a low power of the microscope, and noting the point as which the nuclei of the cells become sufficiently clear. The method requires some practice before the best results are obtained.

Mallory and Wright recommend the following -

t Strin in easin (5 per cent aq sol) for twenty minutes or longer

2 Wash in water

3 Stain in Unna's alkaline methylene blue (one part in five of water) for ten to fificen minutes

Urna's Alkalane Methylene Blue

Methylene blue .		٠	1 grm
Carbonate of potassium	-		1 grm.
Water		-	120 001

4 Wash in water

5 Differentiate in alcohol, clear and mount

According to Malloty and Wright the success of the method depends upon the presence of colophonium in Halcohol used for differentiation. This is usually present in alcohol, but it may be necessary to add it in such quantity as to make a 10 per cent solution

A stain which gives very similar results is prepared by diluting Leishmans stain with nine parts of water. The sections are allowed to remain in this stain for twenty four bours. They are then differentiated in a very dilute solution of acetic acid (1 1000), washed in water, dehydrated, cleared and mounted in balsam. This makes an excellent counterstain instead of methylene blue after using Ziehl Neelsen's carbol fuchsin for staining tuberled bacilli

Pyronin Methylgreen Method (Unna Pappenheim)

This is a useful method for differentiating the various types of cells in inflammatory ussue, more especially for demonstrating 'plasma cells' The staining mixture (pyronin methylgreen) is best obtained ready made from Grubler

- I Fix in alcohol, formalin, or Orth's fixative
- 2 Stain in pyronin methylgreen mixture for 10-15 minutes, warming the slide slightly
 - 3 Wash in water for several minutes
 - 4 Differentiate in 70 per cent alcohol
 - 5 Dehydrate rapidly, clear, mount
- By the above method the protoplasm of the "plasma cells is deep red, the nucleus green

Elastic Tissue Stain

Elastic fibres enter into the formation of many tissues and organs in the body. More especially is this the case with the lungs and testicle and with vessels (other than capillanes) and skin. In studying pathological changes in these tissues it is therefore absolutely necessary to employ some method for the demonstration of the elastic fibres. A number of

staining methods will show elastic fibres, but for the study of changes in these fibres special selective methods must be employed. Of these selective methods, undoubtedly the best is Weigert's resorron fachsin method

The stain may be obtained in the form of powder or fluid, but it is easily prepared as follows .--

Resorcin 4 grm. Fuchsin (Grubler) 2 grm.

Bring the mixture to the bod in a porcelain dish, and add $z_0 \in c_0$ the liquor ferr sesqueholeral (Pharm Gerri S G r 1). Biol for five mustes, stirring at the same time. A precipitate form which after cooling is filtered. This precipitate is a post of the same time in the same time in a dissolved in 200 c.c. of 94 per cent alcohol, beat being applied till the alcohol beat. The solution is then allowed to cool, made up to 200 c.c. with alcohol, and 4 c.c. of hydrochiors and added of

Methox

Tisues are fixed in formalm or corrotive, hardened in alcohol and cut in paraffia, celloudin, or better, in gum with the freezing microtions. It is well to cut the actions fairly thick (2-04 μ) in order that the annuosities of the fibrest may be followed. Tisue hardened in alcohol must of course be washed thoroughly in water (twenty four hours) hefore being placed to reum.

2 Stain sections in 1 thium carmine one to five minutes (parallin sections twenty four hours).

Orth's Lathium Carmine

Carmine . . 5 grm.
Sat aq sol of hihum carbonate . . 100 c.c.
Thymol, a few crystals.

3 Differentiate in acid alcohol (p. 421) for one to twenty four hours. The longer the sections are left in this the better the result.

4 Place direct in resorcin fachsin mixture for ten minutes (gum sections) to one hour (paraffin sections). The stain

tends to become less active on Leeping, but the differentiation is better

- 5 Differentiate and dehydrate in absolute alcohol. In the case of gum sections, this is best done in a "Petri dish" so that the section can be spread out on the slide while in the alcohol.
 - 6 Clear in carbol xylol or carbol benzol

7 Afterwards in xylol or benzol and mount in balsam.

By this method the elastic fibres are stained dark blue, the

by this method the elastic tissue stain can be used along with other staining methods. A very good combination is the following—

Stam in iron hamatoxyhn, then in Weigert's resorcin fuchsin, and finish up with picro-fuchsin.

Fibrin Staining Method

Weigert's fibra method is merely a modification of the Weigert Gram method for staning bacteria, and sections staned with it will also show gram positive organisms. The method is particularly adapted for demonstrating the exudate in acute inflammations of pleura, pericardium and lung, also for the fibra network in thromb.

Method.

- t Fix in formalm or corrosive sublimate, but not in Muller's or Orth's fluid.
 - 2 Cut in gum, paraffin or celloidin,
- 3 Stam in lithium carmine (see p 426) in the case of paraffin sections for some hours, in the case of gum or celloidin sections for one to five minutes
- 4. Differentiate in acid alcohol for some time, best twenty
 - 5 Wash well in water
 - 6 Stam in anilin gentian violet (p 446) five to ten minutes.
 - 2 Pour off excess and blot carefully
 - 8 Mordant in todine solution for two minutes.

Potassium iodide . . . 5 grin
Water . . . 5 grin
Godine in excess.

- 9 Pour off excess and blot firmh
- Differentiate in and n kylol (equal parts of anilia oil and kylol).
 - 11 Clear in x lot mount.
- By this method the fibrin is stained blue while the nuclei of cells are stained red.

Staining of Fat in the Tissues 1

Fat occurs in the insues as (1) neutral fats (combinations of fatty acid and gh_ceme) (2, fatty acids (palmit, c, stair, or oleic) (3) scaps (combinations of fatty acids and alkalespotassium, sodium, or calcium) (4) combinations of fat with protein (albumm soaps). All the first three varieties are demonstrable by microchemical menis, the last only by chemical analysis.

In order to demonstrate fat by stanning methods it is neces any order to demonstrate fat by stanning methods or necessarily of the standard from the formalin. The portion of issue is taken direct from the formalin and froren, or it is placed for some hours in gum (p. 405) and then cut Trissues passed through the usual regents and cutto parafile or celledin have all their fattemoved, unless they have been fixed previously in come noid, which stains certain fats black, or so a chrome solt such as bichrom ate of potash.

Haste anilin dyes will stam fast in the form of free fatly acid by combining with them to form coloured kapp. At a rule fatty acids occur in small amount in the fat of tissues, although in some mobile conductors (e.g. fat inecreasily they are present in large amount. The neutral fats, which are the pre-dominant form, are, however, readily hydrolysed by the action of acids and so splt into fatty acid and glyceine. The car bonic acid of the atmosphere will act in this way. This hydrolysed fat will take on the basic anilio dye. In this way the fat in sections stained with such a dye and exposed to the air or to the action of an acid such as sulphurous acid gradually combines with the dye and so becomes coloured. In

¹ Lorrain-Smith and Vair fournel of Pathol or and Exciterably 1906, vol. si. p. 415 ib d. 1908 vol. si. pp. 1-756 134 ibid. 1908 vol. sia, pp. 14-345 ibid. 1912 vol. xv pp. 53-180 other words, globules of acid fat are stained immediately with basic anilin dyes, while globules of neutral fat remain unstained until they have been hydrolysed and the fat has become acid

Demonstration of Fat by Hæmatoxylin. — Fat in the issues will stain with hæmatorylin, in a similar way to myelin in Weigert's method, after partial oxidation by fixation in bichromate of potash or in chromac acid. The fat, however, takes considerably longer than the myelin to reach the stage of oxidation at which it will "blee" hematoxylin.

In order to stain sections of fairy liver in this way the piece of tissue, after rapid fixation in formalin, should be cut in gum and the sections placed in a saturated solution of potassium bichromate at 37°C for a fortnight. At the end of this time they are stained in Kultschitzky's hematoxylin, and differentiated as on p 355, or by means of Weigerts borax ferroyangle mixture prepared as follows—

Borax .		2 grm,
Pot ferricyanide		2 5 gm
Water		100 C C

Demonstration of Fat by Osmic Acid.—For this purpose osmic acid 1 per cent solution in water or any of the fixatives containing osmic acid, such as Flemming's (p 410) or Marchi's (p 410) solutions, may be used. The action de pends upon the reduction of the osmium personde to osmium onde. Only certain fats are blackened in this way, more especially olein and oleic acid. The precess of itsuse treated should be very thin as the osmic acid does not penetrate well.

One advantage of the method is that the tissue can after wards be embedded in paraffin or celloidin, although in the case of paraffin embedding xylol should not be used. Subse quent staming with saframin (1 per cent) gives very good results.

The staining with osmic acid can also be carried out with sections cut in gum. The sections are placed in $\frac{1}{6}$ per cent solution of perosmic acid for 12 hours in the dark, washed well in water, and mounted in Farrant's solution

Lorrain Smith's Nile Bine Sulphate Method — Nile blue sulphate (A) is a dip of the organic series, and like other basic

anilin dyes, it comb nes with fatty acid forming a coloured soan. When sect one of tissue containing fat are stained with it, the larger proportion of the fat globules are found stained a brilliant red, others are stained a deep blue, while others are purple The explanation of this is that the dye in watery solution contains a red substance (oxatone base), which is demed from the blue dye (ozanne base) by a process of oxida tion. This transformation can be carried out more rapidly by heating the blue stain for some hours in the presence of acid. This red exazone base is readily soluble in both fatty acids and neutral fats, and in virtue of this leaves the stain and concentrates in the Lit. This so ution of the die in the fat is a rapid process. Hence the great proportion of the fat in the ussue will be coloured red. The blue stained globules represent the fatty acid portion of the fat which has combined with the basic dye (oxamne base) to form a scap. This process is a relatively slow one.

When both neutral fat and fatty acid are present in a

globule, both stains act, thus giving a purple colour, Method

1 Fix in formalin

2 Cut in gum with freezing microtome

- 1 Place the sections in a concentrated watery solution of Nile blue sulphate for ten minutes
 - 4 Wash in water
 - Differentiate in i per cent acetic acid. 6 Wash thoroughly

7 Mount in Farrant or in glycerine jelly

Method of staining Fats with Sudan III, and Scharlach R .- Sudan III and Scharlach R, are two anihn dyes belonging to the azo group, closely albed to one another, the latter being ncher by two methal groups than the former, and in conse quence being the stronger stain. Both dies are readily soluble in alcohol and in fat, but not in water It is in virtue of their solubility in fat that the colouration takes place. Both stains are capable of colouring all types of fat - fatty acid. neutral fat, and soaps This fact, in conjunction with the ease of staining, renders them the best all round dyes for fatty changes. Because of its more intense staining, Scharlach R. is to be preferred to Sudan III

Method

- I Formalin fixed tissue.
- 2 Cut in gum with freezing microtome.
- 3 Place sections in 70 per cent spirit for a few seconds
- 4 Then in a saturated solution of Scharlach R in 70 per cent alcohol, previously filtered, for ten minutes to twenty four hours in covered dish. (The longer the sections remain in the solution, the more intense is the stamming)
 - 5 Transfer to 70 per cent spirit
 - 6 Wash in water
 - 7 Counterstain for five minutes in alum hæmatein,
 - 8 Mount in Farrant or in glycerine jelly

Owing to the fact that the stains are not very soluble in 70 per cent alcohol, a relatively long period is necessary for perfect staining. The time can be shortened considerably by using one of Herxheimer's methods, of which the following is the best—

70 per cent alcohol		50 C.C
Pure acetone	•	50 C C
Scharlach R.		excess

In the mixture of alcohol and acctone the Scharlach R is much more soluble than in the alcohol alone. Hence two five minutes suffices for staming. Care should be taken to filter the stam before use and to keep the dish covered in which the staming is carried out as otherwise precipitates may occur.

Demonstration of Glycogen in the Tissues

Glycogen is a carbohydrate which occurs in cells, egliver, muscle, kidney, and, more rarely, in intercellular sgbistance. It is readily soluble in water but insoluble in alcohol, therefore the bissue under examination must not be treated with water or watery stams. It gives a dark brown colour with nodine. For ordinary purposes Ehrlich's method is quite good.

Method

- 1 Place tissue at once in absolute alcohol
- 2 Embed in paraffin
- 3 Stretch the cut sections in 50 per cent alcohol.

4 Place a drop of the following mixture on the slide -

Gumarabie

100 parts. Lugol's rodine solution (see below) . I part.

Lugol's Solution

Indine . igrm Pot sodide . 2 gm Water 300 C.E.

Place a cover glass on the specimen and investigate,

In order to obtain permanent preparations, more elaborate methods, such as Lubarsch's and Best's, must be adopted

Lubarsch's Method

- 1 Fix tissue in absolute alcohol, embed in paraffin, cut. stretching sections in 50 per cent alcohol.
 - 2 Stain in Mayer's alcoholic carmine for several minutes.

Carmine .		4 grm.
Water .		15 c.c.
Hydrochlone acid		30 drops,

Dissolve by boiling, add 95 cc of 85 per cent alcohol; filter in warm condition and neutralise with ammonia until a permanent precipitate forms, then filter in the cold,

- 3 Differentiate in acid alcohol (see p 431).
- 4. Wash in absolute alcohol
- s. Stain in methylanilin siolet solution as for Weigert's fibrin method (p 427), warming slightly for two minutes.
- 6. Wash sery rapidly in mater 7. Pour on Lugol's solution (see above), and leave for
- to seconds
 - 8 Dry with filter paper o Differentiate in-
 - Andin oil . . 2 parts. Xylol 1 part,
 - 10 Clear in xylol and mount in balsam.

By this method the glycogen is coloured blue violet and the nuclei of the cells red.

Best's Method

- 1. Fix in absolute alcohol, embed in celloidin and cut.
- 2 Stain in Weigert's iron hæmatoxylin (p. 421).
 - 3 Differentiate in acid alcohol.
 - 4 Wash rapidly in water
 - 5 Stain in ammonia carmine prepared as follows

Carmine			2	gnn
Pot carbonate			1	111
Pot. chloride	٠		5	"
The auntau				

Boil for a few minutes, and after cooling add ammonia 20 c.c. For use take---

Carmine solution		20	parts
Ammonia		30	.,,
Mathel alcohol		**	

Stain in this for 5 minutes to 24 hours

6 Place in differentiating fluid for several minutes until the section is again blue Differentiating fluid—

Abs alcohol		40	parts
Methyl alcohol		20	11
Dist water		ro.	

7 Wash in 80 per cent alcohol,

8 Dehydrate in alcohol, clear in xylol, mount in balsam

In the above method the hæmatoxylin may of course be omitted Parafin sections may be treated similarly if, after dissolving out the parafin with xylol and washing off the xylol with alcohol, the sections are placed in the reliading for 30 to 4 hours. At the end of that time they are placed upon a slide and stained in Best's carmine. The glycogen by this method is stained red.

Demonstration of Calcareous Material in the Tissues

Hæmatoxylin and hæmatem stain calcareous material dark blue

Von Kossa's Silver Method

- t Fix in formahn for a short period, and cut with freezing microtome
- 2 Lay the sections in 5 per cent silver nitrate in the light for 10 minutes to 1 hour
 - 3 Wash in distilled water
 - 4 Transfer to a 5 per cent solution of sodium hyposulphite in order to remove excess of silver nitrate.
 - alphite in order to remove excess
 - 6. As a counterstain safranin (1 per cent watery solution) may be used
 - 7 Dehydrate, elear, mount
- In carrying out the above method phosphate of silver in formed by interaction between the silver nitrate and the phosphates of calcium and magnesium. Under the influence of light the silver salt is reduced to metalite silver which appears in the section black.

Stains for Amylold or Waxy Substance

Amyloid or waxy degeneration is a change which affects

connective tissue, chiefly that in relation to blood yessels.

The tissue becomes swollen, transparent, and homogeneous.

The material of which this degenerated tissue is composed is an alturation to decombined with chondrottin sulphytic acid.

Tissues containing waxy substance should be fixed in formain and hardened in spirit, but should not be kept too long in either fluid, as the amylood thatenal tends to lose its characteristic staming properties in these fluids. It is possible, however, to stain sections successfully which have been kept for versa; is some

Sections are best cut in gum after the spirit has been thoroughly washed out with nater. The way material is well demonstrated by such ordinary methods as heematoxylin and peero-fuchsin, by which means it is stained a yellow brown.

colour There are two selective methods for waxy material —(a) iodine, (b) anilin stains

(a) Iodine Method —The sections cut in gum are placed in an iodine solution.—Gram's or Weigert's (p 446) solutions are both suitable — and left there for two to five minutes. They are then mounted in glycenne jelly without washing

By this means the waxy material appears, by transmitted light, a golden yellow, by reflected light a mahogany brown.

(d) Antim Stanns — A number of annin dyes, which are matures of several different chemical compounds, such as methyl violet (a maxture of treira, penta, and hexamethyl mannin), gentian violet (a maxture of the chlonde of penta and hexamethyl pararosantin), polychrome methylene blue (formed by bolting methylene blue with an alkali and containing methylene violet), show characteristic staning with insiste containing waxy material. In other words, such ussues when stanied by one of these dyes show the waxy material a pink or purple colour while the rest of the tissue is stained blue. Methyl violet is probably the best known stain.

Method-

- 1 Stain sections in a 1 per cent solution of methyl violet in water for several minutes
 - 2 Differentiate in acetic acid, i per cent in water
- 3 Wash thoroughly in water Best for twenty four hours in several changes
 - 4 Mount in glycerine jelly or a watery solution of levulose

Demonstration of Iron-containing Pigment in the Tissues

The sections may be fixed in formalin and cut in paraffin or in gum. The latter is best for the purpose

Method-

- 1 Lay the sections in a 2 per cent watery solution of ferrocyanide of potassium for a few minutes
- 2 Transfer to hydrochloric acid i per cent in water (acid alcohol may be used), and leave for one to two hours.
 - 3 Wash in water

The sections may be counterstained in eosin or, better, in alum carmine prepared as follows —

Carmine . . 2 grm. Alum . . 5 grm.

Water . 100 C.C.

Boil for one hour, allow to cool, and filter

Sections should be stained for ten minutes (gum or celloidin sections) to twenty four hours (paraffin sections).

Demonstration of Chromaffin Cells

In cases which had symptoms suggestive of Addison's disease during life it is necessary (p. 4.2) to investigate the chromaffin cells (cells, f.e., which have an affinity for chrome salis) are found in the medullary portion of the suprareasls, in the caronid body, etc. For the demonstration of such cells the tissues should be fixed in Muller's or Orth's fluids, cut in gum, and stained in some nuclear stain, e.g. polybrone methylene blue, to bring out the nuclei of the cells. After such treatment the chromaffin cells argume a crass resea colour.

Weigert's Method for staining the Medullary Sheath of Nerves

Methods for staming the medullary sheath of nerves are all founded upon Weigert's method, which consists in fixing the ossue in potassium bichromatic, floor chrome, or some such mordant, subsequently staming in harmatoxylin and different tating. Under the action of the bichromate, the melini substrace of the medullary sheath becomes partially nodised Lorian Smith and Mair bring forward evidence to show that it is probably cholesten in the form of a loose combination with a fatty acid which becomes sendered during bichromating. The outdation, if not too prolonged, is only partial. There is still an unsaturated grouping On treatment with hematoxylin further outdation occurs. The outded of chromium present in the myelin combines with the harmatoxylin, so that "ikking" of the hematoxylin, and therefore staming of the myelin sheath takes place. It is possible to prolong the treat ment with the backmonate to such an extent that there is

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complete oxidation of the myelin substance, when no staining occurs on placing the tissue in hæmatoxylin

By this method the myelin sheath is stained a dark blue black. Any area of brain, cord, or nerve, where the myelin substance bas disappeared, will remain unstained. The method is adapted for demonstrating such degenerated area. They may be brought into greater prominence by counter staining in piero fuchsin (van Gieson's stain) when the degenerated area appears bright red

The tissue having been mordanted in potassium hichromate, of m Muller's fluid (see p. 409), for some six weeks, hardened in alcohol, embedded in celloidin, and cut, sections are placed in some preparation of harmatorylin, of which one of the best is Kutischityk and Wolter's, prepared as follows —

Hæmatoxylın		ı grm.
Absolute alcohol .		10 CC
Acetic acid (2 per cent)		99.00

This solution should be prepared at least a week previous to using It keeps well, and indeed improves on keeping

Method-

- 1. Stain in hæmatoxylin twelve hours at 37° C.
 2. Wash in water.
- 3 Place in \$\frac{1}{4}\$ per cent watery solution of potassium permanganate for twenty to thirty seconds
 - 4 Wash in water
- 5 Differentiate in equal parts of sulphurous acid and water for a few minutes, se until the grey matter is colourless.
 6 Wash thoroughly in water
 - 7 If desired, counterstain in picro-fuchsin (p. 423)
 - 8 Wash in methylated spirit.
 - 9 Dehydrate in absolute alcohol.
 - 10 Clear in benzol
 - 11 Mount in balsain

After washing with water (2) and (6), it is advisable to leave the sections for some time (one to two hours) in water to which a small quantity of a solution of lithium carbonate has been added.

Marchis Method for demonstrating Degenerated Myelin

In areas of degeneration in brain, cord, or nerve, as the result of disintegration of the myelin sheath, globules of fatty substance are set free These fatty globules will blacken on treatment with perosmic acid, because the fatty substances, having an unsaturated grouping, are oxidised at the expense of the perosmic acid, which is reduced to black oxide of osmium. The normal mychn substance of nerve tissue will act in the same way if sections are placed in perosinic acid, directly or after fixation in formabit. On the other hand, if the nerve tissue containing the degenerated focus he exposed for a short time to the action of bichromate, the normal myelin sheath will not blacken, because exidation of the myelin substance occurs The globules of fat in the degenerated area are only slowly oxidized by the bichromate, thus reduction of perosmic acid and blackening of the globules results. As stated elsewhere (p. 429), only the olem compounds react in this way

In order to demonstrate degenerating myelin in this say a portion of spinal coved, brain, or nerve is pheed in formalin for twenty four hours. At the end of that time very thin portions are removed from the larger piece and placed in Marchis fitud (see p 440) for three days. They are then washed thoroughly so muoning water and cut in cellodin. In order to show the nucles of the cells saffanni [1] per cent) may

he ssted

Method of demonstrating Ganglion Cells and their Nisal Bodies

For fixation, any of the fixatives may be used. Nitsl recommends abnotute alcohol. Small portions only of this issue (brain or cord) should be taken. Fixation and hardening is complete in the alcohol is two to three days. Nisal content to the issue embedded in gum arabic hardened by alcohol, but embedding in cells did not arabin eries count rood results.

Method-

1 Stain sections in Unna's polychrome methylene blue (Grubler) for ten minutes

2 Wash in distilled water for some minutes.

3 Rinse in methylated spirit, and then in

4 Absolute alcohol to which one or two drops of acetic acid have been added, and afterwards in pure abs. alc

Differentiation may also be carried out in Unna's glycerin ether mixture (Grubler's) diluted with water

5 Clear

6 Mount (Colophonium dissolved in xylol is recommended for this purpose)

Instead of the polychrome methylene blue, thionin or toluidin

Method of demonstrating Neurosha

The demonstration of neurogia by some selective staining method us of importance in deciding the nature of timours of the central ner ous system, i.e. whether they are glomas or not. It is useful also in cases where increase of neurogia tissue is suspected, as in scars following softenings and homorrhages and in the more diffuse ghosis of general paralysis, Huntingdon's chorea, etc. All the methods are somewhat uncertain in their results, and even successful preparations are apt to show areas which are poorly stained. One of the simpler and more reliable methods is Mallory's

The tissue must be fixed in Zenker's fluid for twenty four hours, either at once or after twenty four hours in formalin

Wash well for twenty four hours in running water

Pass through varying strength of spirit dehydrate, clear and embed in paraffin or celloidin.

Sections are then treated with iodine solution to remove the mercury

Wash thoroughly, changing several times, in 95 per cent alcohol to remove all trace of the iodine

Wash in water

Treat with \(\frac{1}{4}\) per cent potassium permanganate for five to twenty minutes

Wash in water

Treat with 5 per cent oxalic acid five to twenty minutes Wash thoroughly in several changes of water Stain in phosphotungstic acid harmatoxylin for twelve or twenty four hours

Mallory's Phosphotungstic Acid Hamatoxylin

Hæmatein ammonium 0 i grm. Water 100 c c

Phosphotungsue acid crystals (Merch) 2 grin

Transfer directly to 95 per cent alcohol, and dehydrate rapidly with absolute alcohol Clear in xylol and mount in Canada balsam.

MAKING OF BLOOD FILMS

(a) Take some perfectly clean slides Knock off the corner of one of them (to that the end measures a little less than one inch) by making a small scratch with a glass cutter Place a small drop of blood at the end of another slide and with the broken end of the first guide the drop along the surface In this way a thin film of blood will be obtained which reaches not quite to the margins of the slide on either side.

(a) Take a number of perfectly clean square No 2 cover glaases. Place them on filter paper. Lift one of them with a pair of small forceps and remove from the pinched finger or ear a very small drop of blood. (The size of the drop required depends upon the aire of the cover glass, only experience will teach the operator). Allow whice cover glass is presented with each the operator). Allow whice cover glass will spread the blood, and if both slips be clean an even film will be obtained. The lower cover glass is then first even film will be obtained. The lower cover glass is then first grazept between finger and thumb by two opposite angles. The upper cover glass is then first proposition of the forceps and grazept between finger and thumb by two opposite angles. The upper cover glass is then grazept data projecting angle by the forceps and gently tield off the force.

Each film is then allowed to dry in the air The forceps

used should be preferably non-serrated at the points.

Estaining of Blood Films —For ordinary purposes this is
best done by Jenner's, Leishman's, or Wright's stains. In
each case the stam is an eosinated methylene blue dissolved in
pure methyle alcholol. The stains may be bought redy made.

up, or tabloids prepared by Burroughs, Wellcome, & Co may be used These should be dissolved in to e.e. of methylic alcohol. No preliminary fixation is required as the methylic alcohol acts as a fixative. The action if the stain can be limited by drawing two lines across the slide with a grease pencil

- Lesshman's and Wright's Stains—

 1 The stain is poured on to the film and allowed to remain for one to two minutes.
- 2 Add an equal quantity (circa) of distilled water by means of a glass pipette. Mix by gently rocking, and leave for three to five minutes
- 3 Pour off the stain and add from time in time distilled water, rocking the specimen to and fro until the thinner portions become pink.
- 4 Pour off the water and allow the film to dry in the air These stains are also excellent for demonstrating parasites, such as malaria, trypanosomes, etc.

Tenner's Stain-

- 1 Pour on stain and leave for two to four minutes
- 2 Wash off with distilled water, controlling the differentia tion by examining under the microscope
 - 3 Dry in the air, placing in a sloping position.

BACTERIOLOGICAL METHODS OF INVESTIGATION

Requisites

A bunsen burner or, in the absence of gas, a spirit lamp should be close at hand A number of sterile pipeties made by drawing out suitable glass tubing in a blow pipe, and rubber teats, a looped platinum needle, a flat piece of metal blood agar slopes), and a number of clean slides sbould be within reach. When culture tubes foroth and agar and within reach. When culture tubes are not available, several sterile test tubes, or, better, sterile swabs in test tubes for removing samples of exudate, will serve the purpose. In his laboratory the pathologist should, of course, have an incubind, does for staming, etc., etc. A pencil for writing on glass will be found useful.

Method of inoculating Culture Tubes

Stenlise the platnum needle by bolding it obtiquely in the fame. Turn round the cotton woul plug of the culture tube to be inoculated so as to ensure its easy removal. Holding the platnum needle in the light hand like a pen and the culture tube in the left, remove some of the excidate or pus, an assistant holding open with forceps the incusion previously made into the sterous sac, aboses, or organ Crasp the cotton wool plug between the right ring and lattle fingers and remove it. Smear the surface of the agar tube with the exudite. In the case of the broth tube, rub the loop of the needle against the side of the tube at the unover level of the fluid.

Owing to the fact that bacteria of all kinds rapidly invade the body after death, chiefly from the alimentary canal, bac teriological investigations carned out upon the cadaver are not nearly so reliable as those performed during the life of the patient Pathogenic microbes tend to die out and their place to be taken by the unimportant saprophytic forms which have invaded the tissues At the same time, where cultural investi gations have not been made during life, or where the affected focus is in a part of the body which ordinary clinical methods could not reach, it becomes necessary for the nathologist to elucidate as far as he can the bacteriological aspect of the diseased condition. Although, as we have seen, it is advisable to carry out the examination as soon as possible after the death of the patient for ordinary purposes, it is doubly so when the pathologist has in view any bacteriological investigation. The bacteria which invade the tissues multiply and spread at such a rapid rate that ultimately any exact bacteriological observations become impossible,

Examination of the Blood

This is, of course, best done during the life of the patient by drawing off 1 5 c., of blood from one of the arm seins, in cases of bacterizems, when this has been omitted during fife, it is still possible to carry out the observation after death Unfortunately the blood is the tissue of the body most rapidly invaded by the saprophytic germs. Nevertheless, when carefully done, the investigation is undoubtedly useful.

It has been shown by Canon that it is the blood in the peripheral veins which gives the most reliable results, much more reliable than in the case of the heart

A large vein in the arm should be exposed by cutting through the skin, incresed with a sterile Lnife, and by pressing down from above, a fair amount of blood or blood serum can be collected in a syringe or pipette. The fluid is then added to one or more broth tubes, or smeared over an agar slope, and incubated.

The blood may also be obtained from the heart or from the interior of one of the solid organs, such as the spleen, as will be detailed later

Examination of the Solid Organs

The spleen in typhoid fever, the lung in pneumonia, the liver in cases of abscess formation, the brain in meningitis may be examined in this way

The surface of the organ is seared by means of a red hot flat piece of metal. A surful instrument for this purpose is a copper section lifter. A knife is sternlised either in the flame or by boiling, and a cut is made into the substance of the organ through the seared portion of the surface. A platinum loop is then inserted through the opening, pushed further in if that is possible, withdrawn, and then ameared over the surface of an ears 190e or shaken in a broth tube.

Smears on slides may also be made from the solid organs, more especially spleen or lung, and stained to demonstrate bacteria

Examination of Contents of Hollow Viscera

Bacteriological examination of the intestinal canal is seldom of much use, owing to the multiplication of the organisms of putrefaction. In certain cases however, useful information may be obtained. In typhoid fever, for example, pure cultures of the bacillist typhosus may be obtained from the upper part of the

1 Die Bakteriologie des Blutes bes Infektionikrankheiten Jena 1905

iejanum as well as from the unnary bladder and gall bladder In opening these viscera for anch a purpose, it is well to sear the surface, incise with a sterile knife, and remove a sample of the contents with platinum loop or pipette

Examination of the Contents of Serous Sacs

This is usually the first and the commonest bacteriological problem which the pathologist encounters. Where the presence of puts is suspected in one of the serous sacs, it is necessary to open the sac with certain precautions

Hawing dissected down to the Iming membrane—pleura, pencardium, pentoneum, as the case may be—a clean kinfe (bistoury) and pair of dissecting forceps are taken, the membrane is raised with the forceps and a small incision made. Through this a stenle platinum loop or a pipetic is inserted, a small quantity of the fluid removed and inoculated into a series of culture tubes.

As a rule, the media employed will be broth or agar slope, and where the presence of one of the more deleate germs is suspected, such as the streptococcus, pneumococcus, or influenza bacillus, blood agar or blood serum. Subsequently, a number of films from the fluid should be made and stained.

Where the cavity has been already opened into, that is, before its infected nature was realised, pressure should be exerted upon the deeper parts so that some fresh fluid appears, and as this flows over the edge of the opening a sample for inocula tion may be obtained by means of a platinum loop or upotite.

Blood agar culture 'media may be readily obtained from ordinary agar slopes by smearing with a platinum loop a little blood from the finger over the surface. The linger should be first rubbed at the root of the nail with a little methylated spirit which is allowed to dry. A sharp stab is then made by means of a sharp pointed kinde similarly attentised, a cloth being wrapped round the finger to congest at.

Method of making Films from Pus and Sputum

When the pus or sputum is thick, an excellent method is to place a drop of the fluid on a clean slide, place another on the top until the pus has spread between the two, then slide them rapidly apart. In this way two good films are obtained. Another method is to spread the fluid with the platioum needle laid flat on the glass.

The film is then dired by moving it to and fro well above the bunsen flame, and ultimately fixed by passing it thrice through the filame. Another method of fixation is by means of absolute alcohol. The alcohol is dropped on and left for some minutes, after which it is washed off in water. Still another fixative for films is the following mixture.

> Methylated spirit 9 parts, Formaldebyde , 1 part

This is dropped on and left for thirty seconds to a minute, and then washed off with water

Staining Methods for Racteria

Bacterna are composed to a large extent of nuclear material. Thus when it is desired to demonstrate them microscopically, they are stained with nuclear dyes. Hæmatoxylin and similar dyes, however, only stain organisms fauntly. It is the basic and in dyes which are most commonly used for this purpose, such as methylene blue, gentian volet, basic fuchsin.

As a rule, bacteria do not take un these dies nearly so readily as the nuclei of cells In consequence, it is necessary to enforce their action by (a) allowing the stain to act for a prolonged period, (6) by beating, or (c) by the addition of some mordant to the stain, such as carbolic acid, caustic potash, anilin oil. Once stained, however, the bacteria retain the dye with much more persistence than the nuclei of cells amongst which they may he. Hence it is possible by the use of a decolourising or differentiating agent, such as alcohol or some dilute acid, to bring the bacteria ioto greater promioence and differentiate them from the surrounding cells resistance to decolourising agents is more marked in a group of bacteria which includes the tubercle bacillos. In consequence, the term "acid fast" is applied to them. The tubercle bacillus, after having been stained, resists also the decolourising action of alcohol as well as of acid.

To NE Gram's Method and Welgert's Medification

t Fix film.

2 Filter on to film or section andin or carbol gentian

Saturated solution of anilin oil in water or

carbolic acid t to 40 9 parts.
Saturated alcoholic solution of methyl or gentian

violet . ! part

For films of bacteria or pus this should be left on for two

For sections of tissue it should remain five minutes

3 Wash in water

4 Pour on Gram's or Weigert's todine solution. The latter is three times the strength of the former and is better for this reason. It is prepared as follows—

The rodine is left on for one minute in the case of films, for two minutes in the case of sections

5 Differentiate in methylated spirit.

Some experience is required before this can be done successfully. A few seconds is usually all that is required for firms. In the case of sections, not quite all the blue should be removed.

A better method with sections is to blot the section firmly but carefully with filter paper after the lodine. Then drop on anilin xylol (equal parts of anilin oil and xylol). This may be allowed to act until all the blue has been removed. Rapidly treat with suprit to remove the anilin xylol.

6 Wash in water

7 Counterstain for half a minute in some red or brown stain, such as fuchsin, safranin, Bismarck brown, or lithium carmine considerably diluted.

8 Wash in water
o lo the case of films, dry them well above the fiame. lo

the case of sections, dehydrate, clear, and mount in Canada balsam.

Carbol-Thionin Blue

I Filter on staining solution consisting of I gramme thionin blue dissolved in 100 cc carbolic (1 to 40) author has found this stronger solution preferable to the dilu tion of the above, in the proportion of 1 of the stain to 3 of water, recommended by Muir and Ritchie

Films should be stained for three to five minutes, sections from five to ten minutes. 2 Wash in water

- In the case of films, blot, dry, and, if necessary, mount In the case of sections and thick films of pus
- 3 Decolourise very rapidly in 1 per cent acetic acid in water
 - 4 Wash in water
 - 5 Debydrate, clear, and mount,

The above is an excellent method for demonstrating the ordinary bacteria in films from cultures, in pus and in tissues. It is specially suitable for showing up masses of typhoid bacilli in spleen and mesentenc glands, bacillus coli in liver, bacillus pestis in spleen or bubo, entamaba hystolytica in dysentery, etc. The organisms stain a deeper purple than the nuclei of the cells Red blood corpuscles in properly stained specimens are yellow

Where the organisms are too readily decolourised, as in the case of bacillus pestis sometimes, after staining, instead of washing in water and decolourising, blot the specimen and pour on some anilin oil and rock the slide to and fro until the greater portion of the stain has come out, then use xylol and mount in halsam

This staining method may also be used for demonstrating mucus which takes on a red or purple colour with Thionin blue

Eosin Methylene Blue

This method is given above (p 424). It is well adapted for demonstrating masses of cocci in vegetations, diphthena bacilli in false membrane, abscesses, etc., also entamœbæ in the large bowel or liver

Both this method and the previous one have this advantage over Grant's method that the cells and intercellular fibres of the tissues and bacteria are stained more naturally I for Grant's method the organisms appear often abnormally large, and the tissues tend to be altered by the polyne

Staining Methods for the Tubercle Racillus

A. Ziehl Neelsen Method

I Filter on the following stain usually known as Zichl-

Basic fuchsin			1 part.
Absolute alcohol			to parts
Carbolic acid in water (1	20)		100 parts

Instead of the carbolic (t 20) a saturated solution of anilin oil in water may be used. This should of course be filtered previous to making up.

The best way is to been in a stock boule obsolute alcohol.

The best way is to keep in a stock bottle absolute alcohol saturated with basic fuchsin. This is added to the carbolic water as required.

In the case of films, hold over flame or place upon hot metal slab or coin while steam rises. Remove the specimen and repeat the process twice, the staining occupying three to five minutes

In the case of sections, the above method may be used, the staining process occupying at least five minutes.

The author has, however, found that pixing the sections in the carbol or anilin fuchsin in a jar in the parallin bath at 50-55° C gives much better results, the tissues being less damaged by the heating

2 Wash in water

3 Differentiate in 1 per cent hydrochloric acid in methy lated spint. This the ruthor has found very much better than the usual 25 per cent H₂SO₂ in mater. The advantages

are that there is no danger of decolourising, the alcohol test is applied to the organism at the same time as the acid, and, in the case of sections, the tissues are not damaged as they certainly are by the stronger and Differentiation should be carried out until there is just a slight pink tinge in the film or section. Thick portions of the film will probably be still red, but in any case, in searching for tubercle bacills, such thick areas should be avoided.

4 Wash in water

5 Counterstain in a t per cent watery solution of methylene blue for half a minute

With sections, diluted Leishman's stain gives excellent results. One part of Leishman's stain is added to 10 of ordinary tap water, the section is left in this in a jar over night. It is then differentiated rapidly in acetic acid (1 1000), dehydrated, cleared, and mounted

6 In the case of films, wash in water, blot, dry, and mount

In the case of sections, dehydrate thoroughly, thus removing excess of methylene blue, clear in xylol or benzol, and mount in balsam.

B Much Gram Method

1 Stain film in the following mixture, either heating above the fiame for a few minutes till steam rises or leaving in the incubator at 37° C for twenty four to forty-eight hours —

Saturated alcoholic solution of methyl violet B N

violet B N 10 C.C. 2 per cent water solution of carbolic acid 100 C.C.

2 Apply Gram's iodine for one to five minutes

- 3 Drop on 5 per cent name acid and leave for one minute.
 4 Drop on 3 per cent hydrochloric acid and leave for ten
- seconds
 5 Differentiate in acetone and alcohol equal parts.
 - 6 Wash in water.
 - 7 Counterstain in dilute fuchsin if required.
 - 8. Wash, dry.

More recently Much has used instead of 2, 3, and 4 the following mixture -

Potassium iodide 5 grm.
2 per cent hydrogen permide 100 c.c.

The film is then differentiated in absolute alcohol

By either of the above methods, in addition to the ordinary form of the tubercle hacilius which is demonstrated by methods such as Zielh Necleins, a gramular form of the organism which appears as minute blue black granules is shown. This form is believed by many to be a resting stage or sore form of the bacilius. The granules may occur in a bacillary form or may be found from.

C Method combining Ziehl Neelsen with Much Gram (Much Weiss)

1 Stain in the following mixture for twenty four to forty eight hours

Much's carbol methyl violet solution f part. Carbol fuchsin 5 parts,

Subsequently treat with sodine, sittic acid, etc., as in the Much Gram method.

Method of demonstrating the Club Form of Streptothrix Actinomyces

These bodies are exceedingly variable in their staining reactions. They are somewines demonstrable by mean of Gram's method, but they are more often decolourised. The author has introduced the following method, which has the advantage of bringing the bodies out in striking contrast to their surroundings.

The tissues may be fixed in either to per cent formalin or in saturated corrowe sublimate. The section is placed in the following mixture, which is known as Mann's methyl blue and coun stain.—

1	I per cent methyl blue in distilled water I per cent eosin in distilled water	•	35 C.C. 45 C.C.
	Distilled water		100 C C.

The section should be left in this for twenty four hours A few hours would suffice, but in order to obtain the best results, the longer period is necessary

- 2 Wash in water
- 3 Dehydrate in absolute alcohol to which a few drops of a 1 per cent solution of caustic potash in absolute alcohol bas been added

Treat the specimen with the above reagent until it becomes a bright pink colour

- 4 Wash in I per cent acetic acid in water The section will now become hright blue
 - 5 Wash in water
 - Examine under microscope, and if necessary repeat 3 and 4
 - 6 Dehydrate, clear, and mount
- The above method is a slight modification of Mann's methyl lilue and eosin stain. By means of it the clubs will be stained a bright red colour, while the cells surrounding them, as well as the mycelium on the fungus, stain hine. The stain is not absolutely specific, as red blood copuscles and inflam matory exudate as well as the granules of cosmophil leucocytes and nancratic cells react in a similar fashic cells react in a similar fashic cells react in a similar fashic cells react in a similar fashic.

Method for staining the Capsules of Bacteria

The following is a slight modification of Muir's capsule method, suggested by Dr F E Reynolds It is useful for staming the capsule of the pneumococcus or pneumobacillum hilood, sputum, or pus films —

- 1 Stain in Carbol fuchsin, steaming, for one minute
 - 2 Wash well in water
 - 3 Apply Muir's mordant for one to two minutes Muir's mordant is prepared as follows —

Saturated solution of corrosive sublimate 2 parts
Tanme acid (20 per cent solution) 2 parts
Saturated solution of notash alum 5 parts

- 4 Wash well in water
- 5 Differentiate in methylated spirit for one minute.
- 6 Wash well in water
- 7 Stain in methylene blue for one to two minutes,
- 8 Wash in water
- 9 Dehydrate quickly in absolute alcohol
- 10 Clear in xylol or benzol for five minutes,
- 11 Mount in Canada balsam.

By this method the organisms are stained red, while the capsules of the hacteria, the pus cells, etc., are stained blue.

Hiss's Method

I Stain in the following mixture, heating for a few seconds over the flame until steam rises.

Saturated alcoholic solution of acid fuchsin . I part Distilled water . I part

- 2 Wash off the staining fluid with a 20 per cent solution of copper sulphate
 - 3 Without washing in water dry with filter paper
- By this method the capsules of organisms growing in both as well as these in blood and pus films can be demonstrated.

Mathods for demonstrating Epirochates

- In Films-
- (1) Gremsa's Method.
- I Make a thin film of the fluid to be examined.
- 2 Fix it in absolute alcohol for fifteen minutes
- 3 Dilute Giemsa's stain by adding to drops to to c.c. distilled water and pour over film, leaving for ten to thirty minutes.
 - 4 Wash well in a stream of water and dry.
 - (2) Burrs's Ink Method.
- For this purpose a little "Chin-chin, Pelican" ink is mixed with an equal quantity of distilled water. This mixture should be sternlised in the autoclave and allowed to sediment for some time (two weeks). It is then decanted off the

sediment. With a platinum needle a small quantity of the fluid to be investigated is mixed with a little of the ink on a clean slide and a film made. This is allowed to dry and is then examined with the oil immersion lens.

In Tissues-

For this purpose Levaditi's method gives excellent results.

Thin pieces of the tissues are placed in 10 per cent.

- formalin for twenty four hours

 2 Transfer to 96 per cent alcohol for twenty four hours
 - Place in distilled water until they sink.
- 4 Transfer to 1½-3 per cent solution of silver nitrate in distilled water and leave there for three days in the incubator at 37° C
 - 5 Wash rapidly in distilled water
- 6 Reduce by placing for twenty four to forty eight hours at room temperature in the dark in

Pyrogallic acid	•	4 grm
Formalin (40 per cent)		5 C C
Distilled water		100 CC

7 Wash in water

8 Embed in paraffin or celloidin

After cutting the paraffin sections merely require solution of the paraffin and mounting in balsam

By this method the spirochætes appear black, from the silver which is precipitated in their substance.

EXAMINATION OF SPUTUM, PUS, ETO, FOR THE TUBEROLE BACILLUS

The sputum should be poured into a Petri dish, and by means of sharp pointeo forceps and sensors a suitable portion is removed and placed upon a clean slide. A second slide is placed upon the top of the first and the sputum spread out by pressing the slides together. The two slides are then slid apart and the two films dried and fixed in the flame. Suitable portions for examination are any rounded yellow or white

masses, or, in the absence of these, opaque white streaky material Both slides are then stamed with carbol fuchsin for three to five minutes, the stain being heated until the steam rises A convenient way of doing this is to heat a penny in the flame and then place the shde covered with earbol fuchsin pronthe coin. Where a number of shdes have to be stained at once a useful method is to place two pieces of glass tubing across a sink, the slides are then placed across these, the stain is filtered on, and the slides heated by playing a bunsen flame on them from below. Having been stained, the films are washed in water and differentiated in a 1 per cent mixture of hydrochlone acid and methylated spirit. This medium for differentiating has the advantage that the alcohol and acid test are applied at one and the same time. The slide is then washed in water, counter stained in methylene blue (i per cent watery), washed again in water, dried, and examined under the oil immersion. It is well to examine both slides systematically from one end to the other

Pus or caseous material may be examined in a similar way. The reason for differentiating with and is because a majority of organisms, after statung in carbol fuchsin and beating, are readily decolousted with dibtle need. The tubercle becilits and other germs, such as the bacillus of leprosy, the smegran bacilits, in the most great part of the properties of the propertie

Concentration Method for Sputum, Pus, etc.

Add to the sputum, pus, etc. an equal quantity of 50 per cent antiformia.

Antiformin may be made up as follows ---

Solution 1

Sod carb		to gem
Calx chlorinata	(bleaching powder)	50 grm.
Diet water		100 C.C.

Solution 2

Sod hydrate . . 15 grin Dist water 100 c.c.

For use mix equal parts of 1 and 2, and dilute with equal quantity of water

The mixture is then shaken thoroughly and allowed to remain for two to twenty four hours. At the end of that time it will form a more or less homogeneous fluid. This may be centrifugalised at once and the deposit examined by staining, or Eurich's method may be employed as follows -Acetone and ether (equal parts) are shaken up with the antiformin mixture in a narrow glass vessel. The fluids will then separate into two layers, the acctone and ether being above, and at the point of junction a white precipitate, which contains the larger proportion of any cellular dehris in the sputum, also the micro-organisms and among these the tubercle bacilli. The precipitate is easily removed (after pipetting off the ether) by means of a glass pipette and rubber teat. Films are made from this, stained, and examined. In cases where no precipitate forms at the junction of the fluids, the acetone and ether should be decanted off, and some of the antiformin mixture centrifugalised. Films are made from the deposit. Should such deposit be found difficult to spread on a slide. a little of the original sputum mixed with it will assist matters.

Caseous tissue should be cut up into thin shreds by sectioning with the freezing microtome and the resulting pulp treated with antiformun and centrifugalised. The deposit is then smeared on slides and stained by the Ziehl Neelsen or Much Gram method.

Care should always be taken to see that any distilled or tap water used in carrying out these processes is itself free from acid fast organisms

THE BACTERICLOGICAL DIAGNOSIS OF DIPHTHERIA

It may be necessary in some fatal cases of disease to ascertain whether or not diphtheria bacilli are present in the fauces, tonsils, or mucous membrane of the air passages. The method of diagnosis is the same as in the case of the living subject, and should be carried out as follows —

(a) Films should be made from suspicious evudate in any of the above situations and stamed by (i.) Grains method, (i.) carbol thionin blue (iii), Nessers's method (see below) Char acteristic organ sins may or may not be found. If none are seen, cultures should be made

(4) A sterile swah or platinum needle is mibbed over the surface of any exudate which may be present. If no esudate is present, the secretion covering the tonsil is removed and smeared over the surface of a tube of blood serum or blood agar. This is incubited at blood beat for 12 to 24 hours. Films are then made from the growth which develops, and stained by the above methods.

Neisser's Staining Method for the Diphtheria Racillus

Solutions

A. Methylene blue (Grubler), 2 grm., dissolved in 20 Cc. of 96 per cent alcohol. Add to this 950 Cc. of distilled water and 50 Cc. glacial acetic acid.

B Bismarck brown (Vesovin) . 2 grm.
Distilled water . 1 litre

Method.

Stain films for one to three seconds in A, pour off the excess of stain and blot. Drop on B and leave for three to nine minutes. Wash, dry and examine

By this method the body of the diphthena organism is stained brown while the granules are dark blue. A modification of the method is as follows—

Prepare two staining fluids

Α	Methylene blue .	, tgm
	96 per cent Alc	20 € €
	Glacial acetic acid	30 C.C.
	Distilled water	r litre

В	Crystal violet (Hochst) Abs. ale.	f grm.
	Distilled water .	300 C.C.

Mix two parts of A with one of B

Method

- t Stain in mixture for about ten seconds.
- 2 Wash in water
- 3 Stain in cresoidin (2 grm in 300 cc water) for about ten seconds (the stain should be dissolved in hot water and filtered). 4 Wash, dry, and mount,

tadasa

The appearance of the organism is the same as with the first method. Laybourn's modification of Albert's stain (Journal of Amer

Med Assoc, July 12, 1924, p 121) gives excellent results The solutions are made up as follows -

Solution t	
Toluidin blue	o 15 grm
Malachite green .	0 20 grm.
Glacial acetic acid .	1000
Alcohol (95 per cent)	2 0 C.C.

Distilled water 100 CC Allow to stand twenty four hours and filter

Solution	2	
----------	---	--

tomitte	•	T EIIIs
Pot 10dide		3 grm
Distilled water		300 €€

Technique

- Make smears 2 Apply solution 1 for three to five minutes.
- 3 Wash in water
- 4 Solution 2 for one minute
- 5 Wash in water 6 Dry and examine

AGGLUTINATION TEST FOR ORGANISMS

It is sometimes necessary to carry out an agglutination test in the case of an organismal condition such as typhoid fever (Widal reaction), or in cases of suspected ment poisoning (see p g 350), the serum of the individual being tested as regards its aggletinating power against the germ or germs cultivated from the lesson or from intestinal contents or against stock cultures of known organisms.

The method of carrying out the microscopic test is as

The zerum of the case is secured by centifugalising a quantity of blood or blood-clot obtained from the heart and pipetting off the supernatant fluid. This is mused with normal saline solution by means of a graduated p petite so as to make didutions of 1 in 5, 1 in 20, and 1 in 40, etc.

Another method is to prepare a capilitary pipetit (see below), reales a mark upon it with a greate penal, and draw up, by means of a rubber test, so the mark one portion of the serum and subsequently four portions of the normal station solution, allowing a bubble of air to intereste between the various portions. There are then blown out and mused in a watch glass, thus forming a dutution of one in five. From this the other dutumes can be made in a sundar fashion.

2 A fure culture on solid medium, e.g. agar slope, of the organism against which it is desired to test the serium is obtained. An emulsion is made by musing some of the growth, removed by a platinum needle, in normal saline, thus making a solitions with a distinctly opalescent, but not too turbul, appear ance. This is allowed to settle for an hour, or centrifugalised for a few minutes, in order to set ind of say chumos of bacteria.

A slide with a hollow in the centre is then taken and smeared round the margin of the hollow with vasiefine. A cover slip is cleaned, and by means of a platinum loop a minute spot of the serum (* io fixe) and one of the emission are placed side by side on the cover glass, and, after heating the loop in order to dry it and allowing it to cool, the two are mixed together. The cover slip is then lifted with a pair of forceps, turned over, and placed upon the slide is that the drop hangs in the hollow. The slide is examined under a jobictive, care being taken to cut off the greater part of the light coming from the mitror of the microscope, by means of the line slaghergum. The organisms will usually be seen as minute highly refractlic bales. Assimable, hather and thather. Similar hannow drop.

preparations should be made with the other dilutions of the serum. Dilutions of 1 in 10, 1 in 40, and 1 in 80 are thus obtained. Control preparations may also be made with a normal serum.

After examining the slides under the microscope to see that the bacteria are visible and motile they should be placed in the incubator and again examined after one half to one hour. The presence of clumps of motionless bacteria is indicative of a positive reaction. At the same time a positive result with a dilution of 1 in 10 should be neglected unless there is agglutination in the higher dilutions as well.

In the absence of the hollow stides, ordinary stides may be used

The macroscopic test is carned out as follows -

A series of seven small clean test tubes are put in a rack. Sterile salt solution is added in the following amounts o 8 cc. to the first tube, o t cc to the others. Pipette o 2 c c. of the serum to be tested into the first tube, mix and add o 5 c.c. of the mixture to the second tube. Repeat the process in the cases of the other tubes as far as the sixth. To the seventh tube add o 5 c.c. of saline. To all tubes add o 5 c.c. of suspension of a young culture of B typhosus or a culture killed by beat or hy the addition of formalin. The dilutions of the serum in the first six tubes will be 1 10. 1 20. 1 40, 1 80, 1 160, and 1 320 The seventh tube is used as a control Place the mixtures after shaking in a water bath at 55°C, for one to two hours, and note the tubes in which clumping of the organisms has occurred as indicated by suspended floccula or, in more marked cases, by a definite precipitate at the bottom of the tube.

METHOD OF MAKING PIPETTES FOR REMOVING FLUIDS, ETC

Mark off a section, 6-8 inches long, of soft glass tubing (4 inch bore) with a file and break it across. This is held in the hands so that the centre lies in the fiame of a blow pipe or an ordinary Bunsen burner, the tubing being constantly turned between the fingers so that the fiame plays upon all sides of it. No attempt should be made to draw the two ends of it. No attempt should be made to draw the two ends

apart until the central portion is quite soft. When this has been effected the tube is withdrawn from the fiame, and sery slowly the two ends are separated, until a cap lilary tube of at least iz inches long has been made. The tubing should be held in the same position until it has cooled sufficiently to prevent it bending. It is then broken across in the centre thus forming two pipettes. The end of the pipette should be passed through the fiame before using for the removal of exadate, blood, etc. A rubber text attached at the hoad end will enable the operator to withdraw a considerable quantity of find.

APPENDIX B

EMBALMING

In cases where bodies have to be sent long d stances, it may be necessary to inject a preservative into the circulation in order to stay the progress of putterfaction. The simplest fluid for the purpose is made up as follows —

Formalin
Acid-carbolic (cryst.)

Acid-carbolic (cryst.)

Y pints

A pints

This fluid, to the amount of two gallons (in the case of an adult male), should be introduced by means of ac cannils into the femoral artery or abdominal sorts. The time selected for the operation should be at least twenty four hours af or death, or at a time when ngor morts has just pasted off. If the femoral artery is selected, the ineighting should be made in Scarpas triangle, and the norsile of the injector directed unwards towards the heart.

If a post mortem exam nation has to be performed in addition, this should be carried out at least twenty four hours after the injection.

Preservative fluid should also be introduced into the stomach, intestines, bladder, pleura, and other spaces

The surface of the body may, in addition, be washed with a saturated solution of corrosine sublimate in methylated spirit mixed with five times the amount of glycerine. (C. R. Lox, Pati-Morten Manual.)

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THE END



FIG 1 -Method of opening the abdominal cavity



Fig. 2 —Reflecting the sk n and muscles from the sternum and r bs

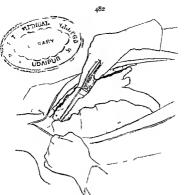
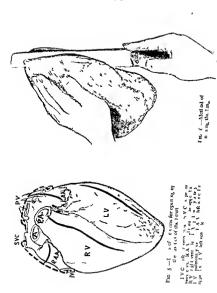
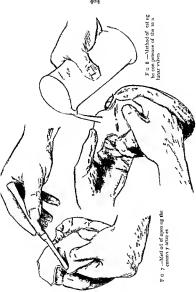


Fig. 3 -Method of cutt ng through sterno clay cular jo nl.



Fig. 4 -Metho I of cutt ng through floor of mouth





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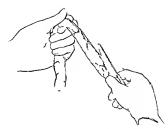


Fig 9 - Method of removing the small intestine

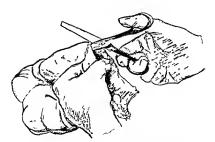
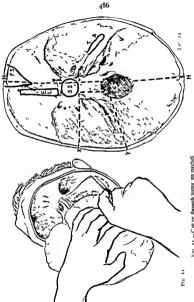


Fig. 10 -Method of opening the bowel after it has been removed



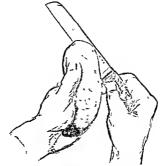


Fig. 13 -Method of maising the kidney



FIG 14 -- Method of statching up

Fig. 15 — Hertt rente paracardus à Fig. 15 — Hertt rente paracardus des openes au d'ur e la , le aloune glach hogen de l'innea apprenance.



Fig. 18—Section through wall of right ventricle showing in crease of sub pericardial lat and futly infiltration of the muscle.



FIG. 17 - Heart chronic interstitial myocurditis ½

Ap cal portion of left sentrele showing white patches of fibeous tissue replacing the muscle substance. The change is most marked at the spex and in the right pap tlary muscle, which has been cut open.



FIG 19 -Thrombus in right auricular appendix 3



FG 20—Heart of h d supe ege a e) endoca d
n a case of ho ea {
ounded g a gra al e se fre ma g



Fig. 21—Aortic valve simple endocard is ½
Vegetations along margin of two segments with red thrombus
attached to one of the vegetations.



Fig. 22 -Heart ulcerative endocarditis of mitral valve

The valve has been the sear of a previous endocard its as evidenced by the throughout of the segments and of the chords tend near the search endocard tend near the search of the left sure of and chords tend near the search of the left sure of and chords tend near the near the wall of the left sure is diazed, due to the mosspecience of the untual valve which existed previous to the ulterative endocarditus. One of two of the chord tend near bear required.

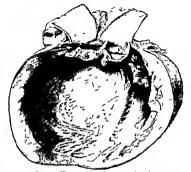
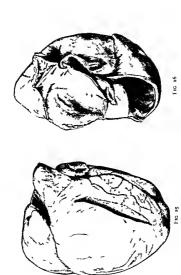


Fig. 23—Ulcerative endocrades a sorte valve. \$\frac{1}{2}\$ The segments had been that even only. They also a red with registe one. One of the segments has reprired. There are an experience who he in the most way to the right. There is marked a listed on of the left ventricle in gety due to the incompetence of the partonic that the most value of the partonic value of value of the partonic value of value of the partonic value of valu



Fig. 24 —Transferse vection of heart 3
Ma ked hypertrophy of left ventricle in case of chronic nephrits. Right ventrile diluted.



110 25 -Anking aspect of least from case of 11 trd stenos s slowing Habition of right nur cle and well marked hypertrop by as well as distation of right we trick

110 26 -Sane heart from above sho ng d'hitation of both aureles. The narrowed mural valve (button hole) can be seen



Fig. 27 — Chron condocarding of nortic value {
Calcareous deposits in the thickened cusps also to on of the segments with consequent 3 enos. 5.



Fig. 28 — Port on of descending thoracid acrts. 2 Showing advanced atheroma. Thromb thave formed in one or two places.



Fig. 29 —Arteries at base of brain { Showing white patches of atheron atous change.

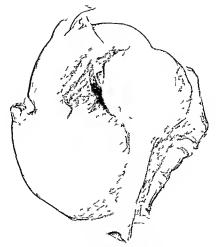
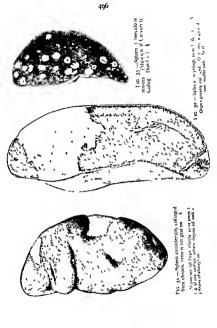


Fig. 30 —Saccular anearysm of descend - g north adde ont to and eroding the bod es of the - ertebrae - $\frac{1}{2}$





F & 34 —Speen and spe culus sago any ½

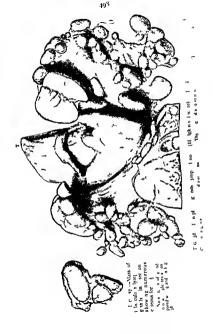


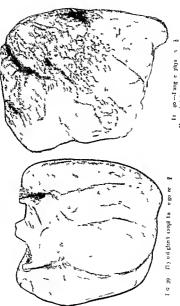
I G 33.—Spice Hodgl. n s d sease show no nume ous scattered be masses a ying n sile \frac{1}{2}

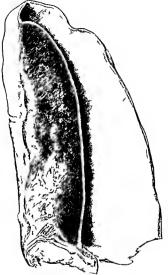
The organ con deaby enlaged.



F G 36 —Splee Hodgk n s d sease (Dr Byrom Bramwell s case) ½ Sue ke a eas form ng large tumou ke masses.







FG 41 —I ung col pse d e to en pyema Th kenng fpa alandvice al per a.

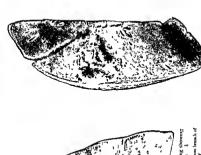


The whole of the upper lobe and the pper port on of the lower lobe are consol dated and it the tage of grey bepat sat on. The lower po t on of the lower lobe to congested.



FIG. 43—Lung and bronch—showing acute brouch is and septic brouch-ye cutton it.

The borth—s—a set by the coape of enucous membrane of he bouch be onche-personned by the defined pale a cas of consoluda win scale of though the lung.



1 16. 45 ← Port on of lang showing two recent infarets 4

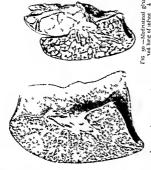
(a) Throat is projecting from branch of 5 the or any arrey



FIG 45 ~ Lung gangrene 3
he dark areas in the centre are gangrenous cavities. The
Tade some around is due to pircumonic consolidation



Raised bard, grey areas, surrounded with blick pigment, mattered in groups under pleura, around sessels and bronch, and along interlobular tepts.



In 49 -Lung reute mlary







Fig. 51 —Lung ciscous (tuberculous) pheumonia with crisist on 4

There is caseous consol distors of the spper portion, with numerous acute of it es. In the lower partiest there are groups of subercles arranged in a staphyle dimanner and cating lymphatic aprend. The pleura is thickened.

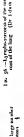
I IG 54 -Surface of lang acute pleansy &



cultosis with cravity in which ra naturation (A) has formed if The stace I elween the antenys and saw was the wall of the cravity as filed with I food elm. To get one extensa filed with treed through the lunar weathers. to melenal be been than solutions and June 1- 53 51

with Digment are relatered stregularly through the I we chrome event en one mapes of upper lobe, the oil er is apes of lower lobe, surrounded by favor-tie and shows a gendency to contract and p. Il upon surrou. Ing. large, enoung "tracts in emply sens Lie 53 -I ung fbro cascons televislos s with meried tendency to healing Nod iles of chimm. fibro enco is tubercle surne ad remunder of the organ





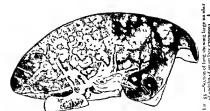




Fig 57 —Squamous epithelioma of ersophagus with mirked narrowing of lumen 1



Fig. 58 —Peptic ulcer of stomach with open ng into vessel in floor of ulcer. 1



Fig. 59 —Large duodenal ulcer (Dr. Cattenach's case) ½ Passureas forming floor. Opening into large westel at one point from which fatal hæmor rhage occurred.

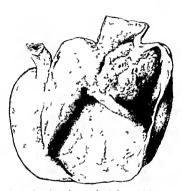


Fig. 60 --- Stomach opened up anteriorly to d si lay en eq lalo l enneer close to card ac opening.





Fig 62 —Typhoid lesion of small intestine &

Early stage showing swelling of Peyers patch and solitary foll les.



Fig. 64 —Tuberculous ulcer lower portion of ileum 1/2
Note transverse direction its sed margin and irregular floor



Fig. 63—T) pho d lesion of small totestine }

Later stage with necrosic of swollen patch and formation of slough.



Fig 65—7 uberculous ulcer perttoneal aspe 1 showing ra sed tubercles under perstoneum 1



F10 66 -- Large intestine interprise colors (dysentery) & Lines of hypertrophied mucous membrane is in ulcerated surfaces between in which she musoular coat is laid bare.



Fig. 67 —Fortion of large bowel from case of amorbic disentery showing characteristic early letton §

Minute grater like ofcess with central slow, b

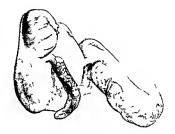


FIG. 68.—Non-e append citis and peritorists. \frac{1}{2}

The append x is swellen and course sed and has reprieted at two points. The point of small intest is seen as covered in pair with a thick layer of fib no exidate.



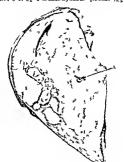
Fig. 69 —Pelvic colon with adeno care noma projecting into interior — \(\frac{1}{2} \)

The wall of the gat — hype troph of also ve



FIG 70 —Per toneal aspect of loop of ne ne show g tuberculous pe o s. j

There are no we ug u he moren ery from en ged mesen neg d



Fits γt —Abscesses of l are port. l py and a ppc $\frac{1}{2}$ A hombus a suppose ang l mone of sub-halos the port n(t)



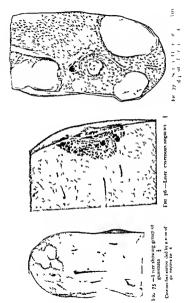
Fir 72 -Liver large t opical abscess with much neerotic liver tissue



Fig. 73—Liver of child showing multiple nodular hyperplas a (re generation of liver substance) following an acute degenerative process (Dr. Byrom Branwell's case)



FIG 74—Liver common cirrhosis, ½
Surface of ergan shows hob-tail "projections. Section shows areas of liver tissue varying in size section ated from one another by bands of connective tissue.





15/G 78 -- Lines, greatly taliarged with numerous secondary nodules of surmons



80 -Biary calcul or gall st no

common face ed t pe mulberry type.

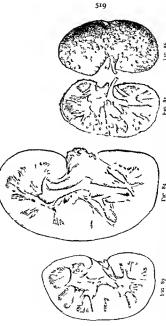
reended sol tary tone omposed frue cholesterm



I to St -Congental eyes ck dney Rounded spares, vary g greatly sure some emist others come a ng i anshoreni gelat non material,



82 -Infarcts of the L dney Three sofarcts vary ng 10 s re are seen 1 she upper pa t of the organ.



A dneys lust at githe minippes of Brightad sense Fic 84

t spyren del torto s greatly swell nan I pele ce and presence of subcapsular cysts Organ ery sigitiy co arged n ried prilor a deome sweling of cort x 83 — Acute nephr 1s Organ ery sligtly on angel 83 — Subatune reph 1s Organ great ye lurge 1 C 85 — Chron e nicest tal nephr 1s Organ d no she 86 — The same surface v ew af er st pp ng erysule 525



For 8" — Andrey pyramic abscesses.

For 8" — Andrey pyramic abscesses.

Guráce v th capsule a ripped

Guráce v th capsule a ripped

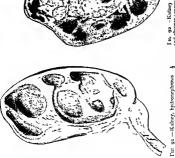


Fig. 89 — It dey tuberculous 4 Act cappe of the I wase. La ge mayors of suberculous fact as tered mainly in groups, through organ, I'rl as lined with zone of cascous tastes.



FIG 90—k d es juherculos s }

Part al de truction of renal t sue form
ing tay es w h ragged walls, an l w h
a cone of caseous t ue around



An S shaped bend in the prefer following an injury

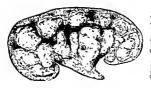
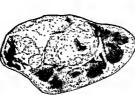


Fig. 93 —Corulline culculus in kidney. §.



Itt. 92 - Kidney hypernephroma and chrome venous congestion 3

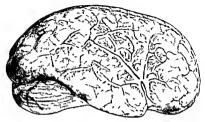
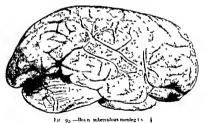


Fig. 94—Bean showing acute nienges. §
There is general promience of the vessel and essues as the sules and fix respects by the hybrian fixure.



Entitle extending up the 'sybians fit use and break ug up into discrete fail (tulercle) along the distribution of the smaller arisens to the suits and o are the convolutions.



hydoceplaus A enonofar en seoda abas meng

letustigungla on rght s to &



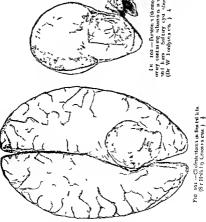
Fig. 93 — terebellum with deprissed areas from softening of the misubstance the rothrombos sun arteries.

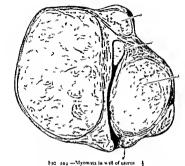


Fig. 99 —Verrical a ction of tiran showing lunge softers abscess
in ten poro spheno tal lote.



Fig. 100 — Fransterse section of pone showing harmorrhages nto its substate e }





sub-cross type. I fatras unal type | r sub-sucross type. | if a licates position of os ute s



Fig. 105 - Enlargement of costo-chondral functions (rickety rosary) in rickets.

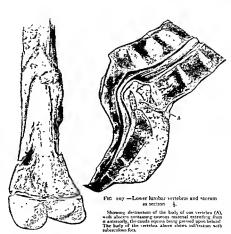
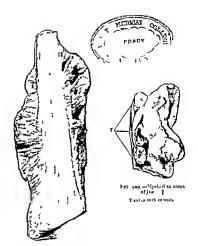


FIG 106 —Chronic osteomy elitis of lower end of femur ½ A new casing of bone is seen above, below is necrosed hore with openings (cloacie)



F1 108 -Ostro-sarcoma of shaft of femur 1